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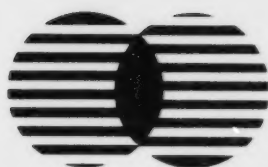
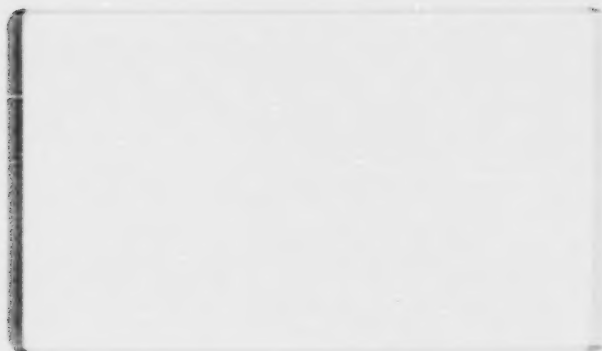
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WAFERBOARD/OSB FACILITY
MARKETING FEASIBILITY STUDY
PHASE II
NORTH WESTERN NEW BRUNSWICK

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Table of Contents

1 FOREWARD AND EXECUTIVE SUMMARY	1
1.1 Introduction	1
1.2 Executive Summary	2
2 AN OVERVIEW OF THE WOOD PRODUCTS INDUSTRY, CANADA AND THE UNITED STATES	8
2.1 Major Developments	8
2.2 Softwood Lumber	8
2.3 Softwood Plywood	10
2.4 Waferboard/OSB	11
3 WAFERBOARD & PLYWOOD SHIPMENTS	13
3.1 Canada - Plywood Industry	13
3.2 Canada - Waferboard Industry	15
3.3 Canada - Total Shipments, Plywood, and Waferboard ..	18
3.4 USA - Total Shipments - Plywood and Waferboard	18
4 STRUCTURAL PANEL INDUSTRY CAPACITY	21
4.1 United States	21
4.2 Structural Panel Industry Capacity - Waferboard/OSB	22
5 STRUCTURAL PANEL - DEMAND BY END USE	24
5.1 Introduction	24
5.2 Residential Construction	25
5.3 Panel Demand - Do it Yourself Market	43
5.4 Panel Demand - Non Residential	46
5.5 Exports	48
6 PRICING LEVELS	50
6.1 Pricing - Waferboard	50
6.2 Transportation Costs & Mill Net Sales Price	51
6.3 Future Pricing Level - Waferboard/OSB	53
7 INDUSTRY CONSUMER SURVEY	54
7.1 Introduction	54
7.2 Methodology	55
7.3 Survey Results - Quantitative	56
7.4 Key Findings of Survey	56
8 SUPPLY AND DEMAND FOR WAFERBOARD/OSB	58
8.1 Projected Structural Panel Demand, North America ..	58
8.2 Projected Supply/Demand	60
8.3 Canada	62
8.4 United States	64
8.5 Comparison - Waferboard Supply/Demand to Housing Starts and Population	65
8.6 Summary	67
9 MARKETING SUPPORT	68

9.1 How Waferboard/OSB is Purchased	68
9.2 Sales and Sales Support	69
9.3 Promotional Literature	69
9.4 OSB	69
10 CONCLUSION	70

Table of Figures

2-1 Softwood Lumber Shipments, USA & Canada, 1977-1986 ...	10
2-2 Softwood Plywood Shipments, USA & Canada, 1977-1986 ..	11
2-3 Waferboard Consumption, USA & Canada, 1977-1986	12
3-1 Plywood Shipments, Canada, 1977-1986	14
3-2 Plywood Shipments by Region, Canada	14
3-3 Plywood Shipments, Domestic vs Export, Canada	15
3-4 Waferboard Shipments, By Province, Canada, 1977-1986 .	16
3-5 Waferboard Shipments by Region, Canada	17
3-6 Waferboard Shipments, Canada, Domestic vs Export, 1977-1986	17
3-7 Plywood & Waferboard Shipments, Canada, 1977-1986	18
3-8 Plywood and Waferboard Consumption, USA, 1977-1986 ...	20
5-1 Structural Panel, End Use Market Share, USA	25
5-2 Housing Starts, USA, West, 1974-2005	27
5-3 Housing Starts, USA, N.C., 1974-2005	27
5-4 Housing Starts, USA, South, 1974-2005	27
5-5 Housing Starts, USA, N.E., 1974-2005	27
5-6 Housing Starts, USA & Canada, 1974-2005	29
5-7 Population Distribution by Region, USA, 1980-2000	32
5-8 Housing Starts vs Plywood Shipments, USA	36
5-9 Housing Starts vs Plywood & Waferboard/OSB Shipments, USA	37
5-10 Housing Starts, Canada, West, 1974-2005	38
5-11 Housing Starts, Canada, Ont., 1974-2005	38
5-12 Housing Starts, Canada, Que., 1974-2005	38
5-13 Housing Starts, Canada, Atl., 1974-2005	38
5-14 Population Projection by Region, Canada, 1987-2005 ..	40
5-15 Housing Starts vs Plywood Shipments, Canada	41
5-16 Housing Starts vs Plywood & Waferboard/OSB Shipments, Canada	41
5-17 Housing Starts vs Waferboard/OSB Shipments, Canada ..	42
6-1 Waferboard/OSB and Plywood Pricing, 1983-1987	50
8-1 North American Waferboard/OSB Supply/Demand, 1988	61
8-2 North American Waferboard/OSB Supply/Demand, 1991	62
8-3 Canada, Supply/Demand Waferboard/OSB, 1986-1988	63
8-4 Comparison of Population, Housing Starts, Wafer- board/OSB, Supply/Demand, % by Region, USA	66

Table of Tables

1-1 North American Panel Consumption, 1986	2
1-2 North American Waferboard/OSB, Projected Supply, Demand, 1988	3
1-3 Estimated Panel Consumption, US N.E., 1986-1988	4
2-1 North American, Total Lumber and Panel Consumption, 1977-1986	9
3-1 Canada, Plywood Production and Shipments, 1977-1986 ..	13
3-2 Canada, Waferboard Production Shipments, 1977-1986 ...	16
3-3 Canada, Plywood and Waferboard, Production and Shipments, 1977-1986	18
3-4 Canada, Percent Waferboard to Total Shipments, 1977-1986	19
3-5 USA, Plywood and Waferboard Consumption, 1977-1986 ...	19
4-1 USA, Structural Panel Products by Region, 1986-1991 ..	21
4-2 Canada, Waferboard/OSB Capacity	22
4-3 USA, Waferboard/OSB Capacity	23
5-1 USA, Structural Panel Demand by End Use	24
5-2 North America, Housing Starts, 1974-2005	26
5-3 USA, Housing Starts by Region, 1974-2005	28
5-4 NAHB vs APA Projections, 1987-1991, US Housing Starts	30
5-5 Housing Formation Rates, USA, 1970-2000	31
5-6 Sample Calculation, Housing Starts, 1995-2000, USA ...	31
5-7 Population Projections, USA, 1980-2000	32
5-8 Regression Analysis, Housing Starts vs Plywood Shipments, Canada & USA, 1977-2005	34
5-9 Regression Analysis, Housing Starts vs Plywood and Waferboard Shipments, Canada & USA, 1977-2005	35
5-10 Housing Starts Canada, 1974-2005	39
5-11 Five Most Common DIY Projects, USA, 1985	44
5-12 Sales of Existing Homes, USA, 1986-1988	45
5-13 Average Sales Price, USA by Region, 1982-1986	45
5-14 Non Residential Buildings, 1985 Construction Value (\$), USA, 1985	46
5-15 Non Residential Building Construction (\$), Canada, 1986-1987	47
5-16 USA Panel Exports/Imports, 1981-1986	48
5-17 Canada, Panel Exports, 1977-1986	49
6-1 Transportation Costs to Selected US Destinations	51
6-2 Comparison of Truck and Rail Rates	52
6-3 Sample Calculation, Mill Net Sales Price	52
6-4 Retail Pricing, Waferboard vs Plywood, August 1987 ...	53
7-1 Survey Summary	54
7-2 Key Findings of Survey	56
8-1 North American Plywood & Waferboard/OSB Industry, Compared Growth Rate, 1977-1986	58
8-2 Projections, Domestic Panel Consumption; USA, Canada; 1987-1991	59
8-3 Panel Demand By Region, Comparison of Estimates, USA, 1988	59

8-4 Waferboard/OSB, Projected Demand, 1986-1991	60
8-5 North American Supply/Demand, Waferboard/OSB, 1988-1991	61
8-6 Canada Supply/Demand, Waferboard/OSB, 1986-1988	63
8-7 Canada, Waferboard Exports, 1977-1986	64
8-8 USA, Waferboard/OSB, Supply/Demand, 1986-1988	65
8-9 North America, Comparison, Population & Housing Starts vs Waferboard/OSB Production Capacity & Demand	66
9-1 Summary of Responses, "How Waferboard Is Purchased" ..	68

List of Appendices

Appendix 1	Housing Economics: The Outlook for Housing Formations
Appendix 2	List of Persons/Companies Contacted
Appendix 3	Copy of Questionnaire
Appendix 4	Detailed Survey Results
Appendix 5	Respondent's Comments
Appendix 6	Calculations, Waferboard Consumption by Region
Appendix 7	Report No. NER-108 Technical Specifications
Appendix 8	Sample Promotional Literature
Appendix 9	Articles Bibliography

SISKIN MANAGEMENT INC.
WAFERBOARD/OSB FACILITY
MARKETING FEASIBILITY STUDY, PHASE II
NORTH WESTERN NEW BRUNSWICK

1 FOREWARD AND EXECUTIVE SUMMARY

1.1 Introduction

The Province of New Brunswick, Department of Commerce and Technology has engaged N.G.M. International to evaluate the viability of constructing a waferboard/OSB facility in the North Western region of New Brunswick. Siskin Management Inc. has been retained by NGM International to complete the marketing portion of this feasibility study.

The purpose of this report is to provide an analysis of the historical, current, and projected demand for structural panel products in eastern North America with particular emphasis on waferboard/OSB. Of particular interest are the results of on-location and telephone interviews with fifty wholesalers and retailers of structural panel products, specifically waferboard/OSB. The study also reviews economic factors which influence the purchase patterns of structural panel products, for example housing starts and population statistics.

Two kinds of data were used in compiling this report; firstly, hard data collected and published by such organizations as the United States Census Bureau, Statistics Canada and the American Plywood Association, and secondly, soft data obtained through interviews and visits.

The major focus of the study is to determine if there will be sufficient demand for waferboard/OSB to warrant the construction of a new mill in North Western New Brunswick. If the project is viable, it is proposed that the mill be built during 1988-89, with product entering the marketplace in late 1989 or 1990.

1.2 Executive Summary

1.2.1 Current Industry Status

The Canadian Waferboard/OSB industry is dependent on exports to the United States Market to maintain strong production rates. Canadian domestic shipments can be supplied with the industry working at 35% capacity. Current Canadian demand is approximately 850 million sf/year (3/8" basis) and capacity is approximately 2376 million sf/year. Exports of 694 million sf/year represented 45% of industry shipments (1532 mmsf) in 1986. Canada's share of total United States consumption has slipped to 16% in 1986, mainly because new capacity has come onstream in the US. The domestic consumption of waferboard/OSB and plywood (1986) for Canada and the United States is summarized in Table 1-1.

In 1986, the North American Consumption of plywood and waferboard was 26.3 billion sf, 3/8" basis. Total structural panel industry growth rate (1977-1986) was 2.38% per year. By comparison, the waferboard industry has grown at a compound rate of 31.4% per year while the plywood industry has declined at 1.2% per year. Waferboard has 19.3% of the total North American structural panel market.

The North American structural panel (plywood & waferboard) industry operated at approximately 85% capacity in 1986. Plywood production facilities are concentrated in the US West, Canadian West, and the US South. Approximately 60% of North America's waferboard capacity is located in the US South and North Central regions and Ontario.

Table 1-1

1986 North American Structural Panel Consumption
(Million sf, 3/8" Basis)

	Plywood	Waferboard/OSB	Total
Canada	1,823	837	2,660
USA	19,436	4,240	23,676
Total	21,259	5,077	26,336

1.2.2 Future Growth

In 1986, total US and Canadian waferboard/OSB capacity was approximately 6,000 million sf/year (3/8" basis) and total shipments were 5077 million sf. By 1988, total installed waferboard capacity in Canada and the US will be 7.3 billion sf/year, with demand projected to be 6250 million sf/year.

For the purpose of analysis, North America has been divided into four major regions. The West includes the US West, and in Canada, British Columbia and the Prairie Provinces. The Mid region includes the US North Central region and in Canada, Ontario. The South is the US South region. East includes the US North East and Mid Atlantic regions, and in Canada, Quebec, and the Atlantic Provinces. Projected supply/demand for 1988, with projected demand for 1991, for these four major regions of North America is shown in Table 1-2.

Table 1-2					
Waferboard Projected Supply/Demand 1988 North America (Million sf; 3/8" Basis)					
1988	West (Can/US)	Mid (NC/Ont)	South	East (Q/At/NE)	Total
Capacity	1400	2775	1725	1456	7356
Proj. Demand	730	2161	1690	1669	6250
Difference	670	614	35	-213	+1106
1991					
Proj. Demand	943	2796	2213	2169	8121

By 1991, demand for waferboard is projected to be 8.1 billion sf. Assuming that the industry works at 85% capacity, new production capacity, not yet underway, must come on stream by 1989-1990, to meet expected surplus demand (for waferboard) of approximately 700 million sf/year in the Eastern region of North America (Quebec, Atlantic Provinces, US North East.) The US North East is the main importer of waferboard, as Quebec and the Atlantic Provinces have excess capacity.

The US North East region, including the Mid Atlantic States will continue to import approximately 70% of its structural panel requirements.

Table 1-3

Estimated Panel Consumption
US N.E.
1986-1988
(Million sf, 3/8" Basis)

Year	1986	1987	1988
Plywood	3440	3454	3468
Waferboard/OSB	1145	1284	1426
Total	4585	4783	4894
% WB/OSB	24.9%	26.8%	29.1%

With capacity (plywood & waferboard/OSB) in excess of demand, waferboard must be priced to displace plywood, and therefore must be a low cost producer. A new waferboard mill must be able to sell its product at an adequate profit, at a price below the low cost plywood supplier, and the high cost waferboard supplier.

1.2.3 Factors Affecting Waferboard/OSB Supply & Demand

There are several major end use markets for waferboard/OSB. These include residential construction, new and renovations; non-residential construction, and export markets. Current studies completed by the National Association of Home Builders predict that housing starts will decline substantially over the next 20 years. Projections based upon research done by Harvard/MIT and the US Census Bureau, estimate that US housing starts will decrease to 1,350,000/year by the year 2000, versus projected level of 1,631,000 starts in 1987.

These estimates are based upon long range economic and demographic projections. Population shifts are projected for each region of the US for the period 1980-2000 as follows: West, 44% increase; South, 31% increase; N.C., 1% increase; North East, 5% decrease.

Residential uses (both new & renovation) account for approximately 70% of panel demand. The correlation between US housing starts and plywood consumption is very strong. However, when waferboard shipments are added to plywood shipments, and total panel shipments are compared to new housing starts, the correlation weakens considerably. An analysis of correlation data, plus the findings of our indepth survey suggest that a bigger percentage of waferboard is used in the DIY market than is plywood. Our research indicated that the waferboard industry has "a lot of convincing to do" to

persuade many contractors to use waferboard rather than plywood (plywood or lumber in Atlantic Canada) for wall and roof sheathing. In most cases, plywood was used for floor decking for new homes. The projections shown in Table 1-2 for waferboard consumption are optimistic, and are based upon industry historical growth rates. Competitive pricing levels will be even more important in the future for waferboard to regain lost share in the new housing market, and to displace existing plywood usage. Pricing is also critical for waferboard's successful growth in the DIY market. People buy waferboard based on price. These observations were reaffirmed during our discussions with The Waferboard Association (Canada). The waferboard industry must promote and educate at the retail and contractors level. Pricing and product quality must be attractive to entice users to switch to waferboard.

There is also strong competition in all sectors from the plywood industry. The American Plywood Association, which represents waferboard/OSB interests in the US, is promoting the use of waferboard/OSB in non-new housing applications. There is room for waferboard to gain more sales in the non residential construction areas.

1.2.4 Industry Survey

Siskin Management Inc. contacted 50 waferboard/OSB wholesalers and retailers; 25 in Canada, and 25 in the United States. Of those who responded to specific questions:

- 71% say that there is no shortage of waferboard in their area.
- 77% say that they can adequately serve their customers needs.
- 36% say that there is a need for another supplier of waferboard located in New Brunswick.
- 46% say that the market for waferboard is growing with respect to plywood.
- 73% say that the price is the key factor in their selection of a source of waferboard/OSB.
- 67% say that consumers consider mainly price when selecting waferboard over plywood.

Many respondents stated that the panel market was very competitive. In the North East US, because of a narrowing price differential along with changing public perception about the intrinsic value of waferboard/OSB vs plywood, many contractors have switched from waferboard back to plywood for new home construction. The price differential (New England market) between 7/16" waferboard and 1/2" CDX is about \$1.75 per sheet. This represents a premium of \$260 per house to use plywood, which for many contractors was reported to be a

worthwhile insurance premium. It appeared that more people were using waferboard/OSB for new home construction in the Mid Atlantic States than in Upper New England.

Our survey confirmed that waferboard/OSB is purchased as a commodity item. Price is the key factor in the purchasers decision to buy waferboard vs plywood. This puts more pressure on a new producer to sell product at competitive prices and to supply a top quality product.

1.2.5 Conclusion

Assuming that a new Canadian waferboard/ OSB mill can acquire its fair share of the domestic market, the mill must export at least 50% of its product to remain in business. By 1988, Canadian domestic production capacity will be approximately three times bigger than the available domestic demand.

With existing plants under construction (or announced) there will be adequate US and Canadian capacity to satisfy domestic demand in 1987 and 1988. By 1989-90, there is predicted to be (based upon historical growth rates) sufficient demand to warrant construction of several additional plants (700 million sf/year) to serve the US North East Region. (Assumes that the industry works at 85% capacity). It would appear that there will be sufficient future market demand to support this proposed facility. Since it takes 1.5 to 2 years to build a facility, and 4 to 8 months for the plant shakedown, construction of these new plants could begin in the next six months to one year. Additional capacity may also be located in adjoining areas in the US South and North Central regions or Ontario which will also sell waferboard in the US North East.

For a New Brunswick waferboard/OSB mill to be successful in the marketplace, it will be necessary to:

- Be a high volume, low cost producer. A small mill will operate at a cost disadvantage over a larger mill, due to higher costs per msf produced. Costs include capital costs, labour, and operating costs.
- Produce a top quality product. It does not seem likely that a new mill can enter the market with either a shop grade product or a specialty product. The key to success is to produce a competitively priced, top quality, standard board for new home construction and DIY markets.
- Set pricing levels which are very competitive
- Be very aggressive in the marketplace; target large wholesalers/retailers in Eastern North America; maintain a proactive rather than a reactive sales effort.

- Target end use markets in non new housing areas, e.g., DIY and non residential construction uses. The DIY market is growing and is a big end user of panel products. Direct sales to large US DIY chain stores is an excellent channel of distribution.
- Gain an industry reputation for service, quality, dependability, and value.

Although the future market should support increased waferboard capacity in 1989-1991, pricing must also be considered. The market for waferboard is very competitive. The majority of wholesalers/retailers contacted indicated they buy waferboard based upon price, and that quality is assumed to be the same for all brands. The average wholesale price for 7/16" waferboard has been declining over the past few years, with the existing level at \$155 US/msf. Developments in Canada/US Free Trade talks may have some future impact on tariffs applied to Canadian exports of waferboard to the US. Presently the tariff is 4%.

The viability of this proposed new plant is dependent upon (a) the available margin between the mill net price (existing range, \$145 (CDN) to \$155/msf, 3/8" basis) and its manufacturing costs; (b) available wood resource; and (c) end market. Assuming that financial viability and wood resources are acceptable, the new company should concentrate on the marketing aspects to verify channels of distribution for the product, identify key accounts and have discussions to pre sell, or become suppliers for retailers/wholesalers.

The balance of the report reviews these issues in detail.

SISKIN MANAGEMENT INC.

WAFERBOARD/OSB FACILITY

MARKETING FEASIBILITY STUDY, PHASE II

NORTH WESTERN NEW BRUNSWICK

2 AN OVERVIEW OF THE WOOD PRODUCTS INDUSTRY, CANADA
AND THE UNITED STATES

2.1 Major Developments

The demand for reconstituted wood products has grown dramatically over the past several decades. Major developments have included:

- softwood plywood replacing softwood lumber boards for sheathing
- particleboard being developed for use in the furniture industry, replacing hardwood lumber and sanded softwood plywood
- medium density fiberboard making strong inroads into particleboard's traditional markets in furniture and cabinet manufacturing
- waferboard/oriented structural board (OSB) replacing softwood plywood and lumber as a sheathing product.

Waferboard and Oriented Structural Board technology has permitted the use of low grade previously underutilized species in the production of structural panels. Commonly used species have included poplar, or trembling aspen, and mixed hardwoods.

2.2 Softwood Lumber

Lumber is the largest segment of the solid wood products industry, accounting for about 52 per cent of the total value of shipments and more than 50 percent of employment. Shipments of lumber during the first 6 months of 1986 were 19,770 million board feet, an increase of almost 1.4 million board feet from the like period in 1985. Total production for 1986 was estimated at 39,540 million board feet, with the inflation-adjusted value of industry shipments for the year set at \$11.8 billion, a 2.9 per cent increase over 1985.

Table 2-1

TOTAL LUMBER & PANEL CONSUMPTION , (Millions sf @ 3/8" Basis)

UNITED STATES

YEAR	SOFTWOOD LUMBER	SOFTWOOD PLYWOOD*	WAFERBOARD*	PARTICLEBOARD	MDF	PLYWOOD (+) WAFERBOARD
1978	110,803	19,980	259	7,441	1,017	20,239
1979	105,437	18,405	304	7,473	1,013	18,709
1980	87,149	15,415	536	5,900	986	15,951
1981	78,525	14,982	678	5,739	1,032	15,660
1982	86,133	14,741	870	4,786	892	15,611
1983	103,552	17,738	1,706	6,019	1,209	19,444
1984	116,179	18,525	2,803	6,391	1,270	21,328
1985	114,837	18,994	3,505	6,661	1,369	22,499
1986	114,667	19,436	4,240	7,206	1,561	23,676

* includes imports from Canada

CANADA

YEAR	SOFTWOOD LUMBER	SOFTWOOD PLYWOOD	WAFERBOARD	PARTICLEBOARD	MDF	PLYWOOD (+) WAFERBOARD
1978	-8,602	2,347	257	0	0	2604
1979	9,440	2,167	293	802	0	2460
1980	9,530	2,186	311	815	0	2497
1981	9,144	1,964	415	808	0	2379
1982	7,489	1,528	333	635	0	1861
1983	10,423	1,855	536	811	0	2391
1984	11,865	1,652	631	953	0	2283
1985	12,991	1,814	668	1,164	0	2482
1986	14,095	1,823	837	1,287	0	2660

CANADA and UNITED STATES

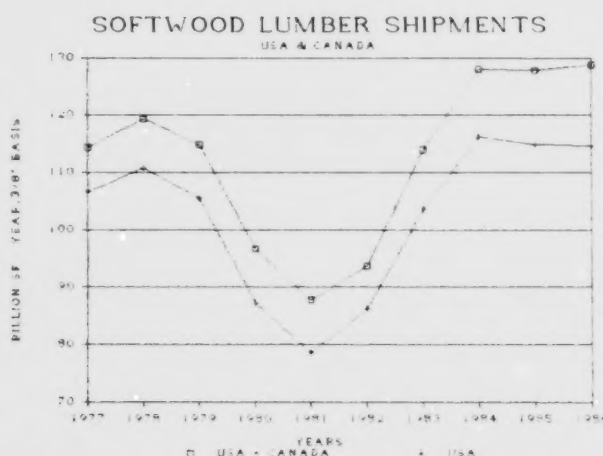
YEAR	SOFTWOOD LUMBER	SOFTWOOD PLYWOOD	WAFERBOARD	PARTICLEBOARD	MDF	PLYWOOD (+) WAFERBOARD
1978	119,405	22,327	516	7,441	1,017	22843
1979	114,877	20,572	597	8,275	1,815	21169
1980	96,679	17,601	847	6,715	1,801	18449
1981	87,669	16,946	1,094	6,547	1,840	18040
1982	93,622	16,269	1,203	5,421	1,527	17472
1983	113,975	19,593	2,242	6,830	2,020	21835
1984	128,044	20,177	3,434	7,344	2,223	23611
1985	127,828	20,808	4,173	7,825	2,533	24981
1986	128,762	21,259	5,077	8,493	2,848	26336

The residential construction industry is the largest single consumer of lumber. Yet despite the upswing in residential construction over the last few years, the lumber industry's profits have not benefited as much as might have been expected. This has been due to a number of factors including production over-capacity and an increase in imports of softwood lumber from Canada, both of which have resulted in lower prices than would have occurred otherwise.

Lumber mills are scattered across the continental United States and are the economic backbone of numerous small communities, but many mills have closed in recent years. The western and Rocky Mountain states produce over 50 per cent of U.S. lumber, while the South, gaining in importance, produces about 35 per cent. The remainder is produced in the Northeast and Midwest.

Softwood lumber dominates the structural wood market, with approximately 130 billion sq. ft. (3/8" basis) consumed in North America in 1986. A summary of major wood products shipped in North America for 1986 shows softwood lumber with 78% of the total market (volume).

Figure 2-1



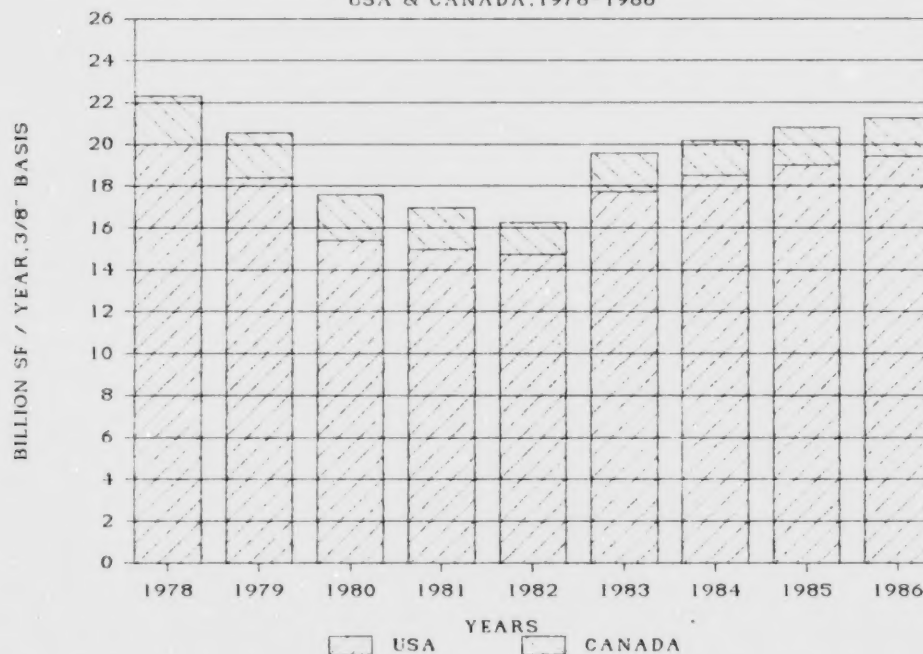
It should be noted that United States shipments are only now surpassing record highs of 1978 of 41 billion BF/yr (110,803 million sf, 3/8" basis). Canadian shipments by comparison have doubled since 1977, to 14 billion sf/year (3/8" basis), or 5.3 billion BF/year. By comparison, Canadian consumption of structural panels has fluctuated from 1.9 to 2.6 billion sf/year (3/8" basis) over the same period.

2.3 Softwood Plywood

Expressed in constant dollar terms, the value of industry shipments of U.S. softwood plywood and veneer products was estimated to have climbed by 9.1 percent, to \$4.2 billion, in 1986. Housing construction, the market for 40 percent of structural panel output, was up by 6 percent in 1986. Strong gains in the domestic repair, remodeling, and renovation market; and in industrial end-uses contributed to the gain. Market

development activities in Europe and Japan, abetted by a weaker dollar, appeared to be bearing fruit as exports in the first half of 1986 climbed by more than 50 percent over year-earlier levels. Shipments to the United Kingdom, the Netherlands, Belgium, and Denmark, where the exchange rate differential increased markedly, showed sharp increases. Together, four countries accounted for more than 60 percent of the United States' total exports through the first half of 1986. Shipments of non veneer structural panels shared the upturn, but softwood plywood shipments made the largest gain in absolute terms. (Source: US Industrial Outlook, pp.4-12)

Figure 2-2
SOFTWOOD PLYWOOD SHIPMENTS
USA & CANADA, 1978-1986



2.4 Waferboard/OSB

Waferboard is a structural composition board panel product produced from engineered flakes and bonded with waterproof resins. Oriented Structural Board (OSB) is a structural composition board panel product produced to improve strength and stiffness in the longitudinal direction. Waferboard/OSB is used for many applications, the majority associated with the use of a structural sheathing, roofing and flooring product for residential/non residential construction, or miscellaneous uses such as framing, crating, containers, etc.

North American Waferboard Sales have grown at a compound rate of 31.5% per year since 1977. Canadian sales represent about 30% of the North American total. However, exports to the United States from Canada are significant, representing 16% of the United States Consumption in 1986.

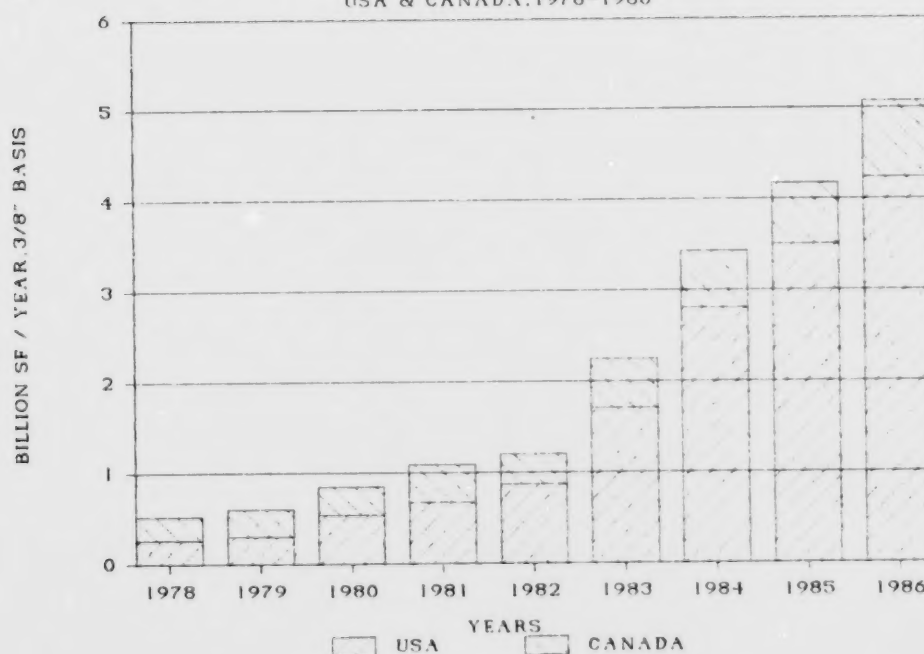
Waferboard gained a significant share of the panel market because it proved to be an excellent plywood substitute in many respects, at prices well below plywood prices.

A number of major factors have influenced the success of waferboard in the market place, including, production efficiencies, utilization of lower cost raw materials, and proximity to end use markets. Because of these comparative advantages, waferboard has been able to compete with plywood on a price basis, however, that price differential is narrowing. According to many retailers and lumber yards contacted by Siskin Management, the narrowing price differential has influenced many contractors to switch from waferboard back to plywood for home construction. The issue of pricing is discussed in detail in Section 6.

It should be noted that waferboard shipments now represent approximately 19% of North American structural panel shipments, 18% in the United States, and 31% in Canada.

United States production capacity surpassed that of Canada in 1982, Major expansion has recently occurred in the U.S. South and North Central regions.

Figure 2-3
WAVERBOARD CONSUMPTION
USA & CANADA, 1978-1986



SISKIN MANAGEMENT INC.
WAFERBOARD/OSB FACILITY
MARKETING FEASIBILITY STUDY, PHASE II
NORTH WESTERN NEW BRUNSWICK

3 WAFERBOARD & PLYWOOD SHIPMENTS

3.1 Canada - Plywood Industry

The softwood plywood industry is based on renewable resources which can be divided into 2 major species groups: Douglas Fir, which is found mainly on the B.C. coast and in the southern B.C. interior, and Spruce - Pine - Fir which is located in most other areas of Canada. Due to competition for these wood resources from the sawmill industry and the long rotation time required to grow suitable sized peeler logs, the available resource base is declining. Waferboard/OSB, on the other hand, is based almost entirely on abundant and rapidly growing aspen which grows in a wide belt across the country from northern B.C. to the Atlantic provinces.

Table 3-1

CANADA

PLYWOOD, PRODUCTION & SHIPMENTS
(Millions Sq.Ft. @ 3/8" Basis)

YEAR	PRODUCTION	SHIPMENTS	WEST	ONTARIO	QUEBEC	ATLANTIC PROVINCES	DOMESTIC	EXPORT
----	-----	-----	----	-----	-----	-----	-----	-----
1978	2,923.7	2,969.6	1,205.5	556.4	459.9	125.3	2,347.1	574.6
1979	2,837.0	2,695.8	1,148.6	466.9	412.7	139.1	2,167.2	528.5
1980	2,641.8	2,717.3	1,170.7	491.4	399.3	124.7	2,186.1	529.2
1981	2,357.1	2,384.5	1,109.6	419.8	326.5	108.2	1,964.0	420.5
1982	1,900.5	1,942.5	820.4	330.0	299.0	79.1	1,528.5	414.0
1983	2,332.1	2,324.7	932.8	424.3	382.7	115.6	1,855.4	469.3
1984	2,086.5	2,085.0	747.5	435.4	364.3	104.8	1,652.0	433.0
1985	2,212.5	2,226.5	787.5	529.8	394.4	102.2	1,813.9	412.6
1986	2,121.0	2,133.1	748.4	563.0	405.8	105.5	1,822.7	310.4

Canadian domestic plywood shipments have ranged from a high of 2.3 billion sf in 1978 to a low of 1.5 billion sf in 1982. Present day shipments of 1.8 billion sf are only 77% of record highs attained nine years ago.

Shipments to the Prairie Provinces and British Columbia remain strong with 40 - 56% of total domestic shipments. At current shipment levels of 160 million sf/year, the Atlantic Provinces represent approximately 6% of total Canadian shipments.

Export sales, mainly to the United States, represent approximately 14 - 20% of total shipments.

Figure 3-1

PLYWOOD SHIPMENTS - CANADA

1000 Sq. Ft. @ 3/8" Basis

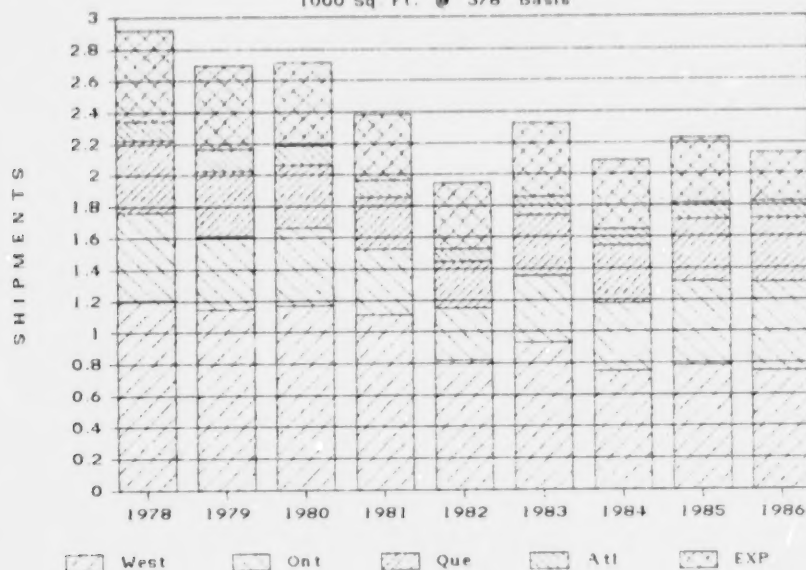


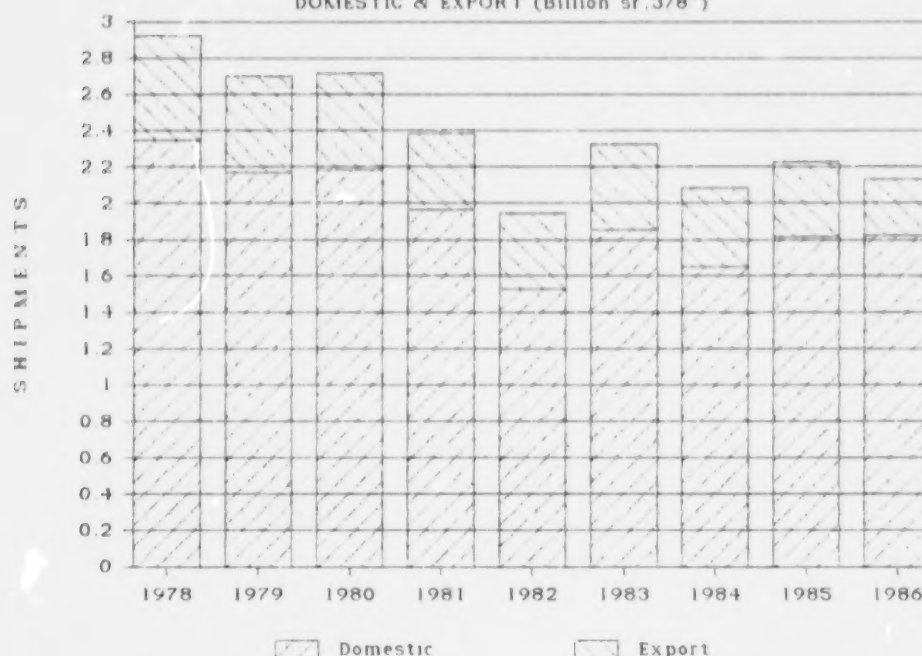
Figure 3-2

PLYWOOD SHIPMENTS - CANADA

1000 Sq. Ft. @ 3/8" Basis



Figure 3-3
P L Y W O O D S H I P M E N T S - C A N A D A
 DOMESTIC & EXPORT (Billion sf, 3/8")



3.2 Canada - Waferboard Industry

Waferboard was first commercially produced in Hudson Bay, Saskatchewan in 1962. Since then, Canada's industry has grown to its present size of 13 plants with a combined annual production capacity of 2.4 billion sf/year (3/8" basis). Between 1977 and 1986, the Canadian Waferboard industry has grown at 15.95% per year. In 1977, waferboard represented 13.8% of total structural panel shipments; in 1986, 42%. Presently a new mill is under construction for Normick Chambord Inc., Chambord, Quebec.

Canadian domestic shipments of waferboard have ranged from a low of 257 million sf in 1978, to today's level of 837 million sf. During the same period, exports ranged from 258 to 836 million sf. The majority (73%) of domestic shipments are to Ontario and Quebec.

Table 3-2

CANADA

WAFERBOARD PRODUCTION & SHIPMENTS
(Millions Sq.Ft. @ 3/8" Basis)

YEAR	PRODUCTION	SHIPMENTS	WEST	ONTARIO	QUEBEC	ATLANTIC PROVINCES	DOMESTIC	EXPORT
----	-----	-----	----	-----	-----	-----	-----	-----
1978	509.7	516.1	65.2	99.1	72.7	20.4	257.4	258.7
1979	643.7	597.2	64.9	119.8	87.8	20.4	292.9	304.3
1980	616.2	651.5	70.2	150.7	68.3	21.9	311.2	340.3
1981	783.7	751.5	107.8	198.1	75.5	33.6	415.0	336.5
1982	556.5	605.7	71.8	166.5	72.3	22.4	332.9	272.8
1983	975.7	961.8	90.5	286.8	130.5	28.2	536.0	425.8
1984	1,345.0	1,346.5	128.6	351.8	110.8	40.1	631.3	715.1
1985	1,511.5	1,504.1	139.7	361.7	122.7	43.6	667.7	836.4
1986	1,522.9	1,531.9	174.8	452.7	155.1	54.6	837.2	694.6

Export sales to the United States have played a major role in the industry's dramatic growth. Export sales represent as high as 56% of total shipments. Tariff rates to the United States are 4% (1987). Exports to offshore markets have been limited by tariffs (10%, EEC), the lack of acceptance of waferboard in European building codes, and limited knowledge of the product.

Figure 3-4

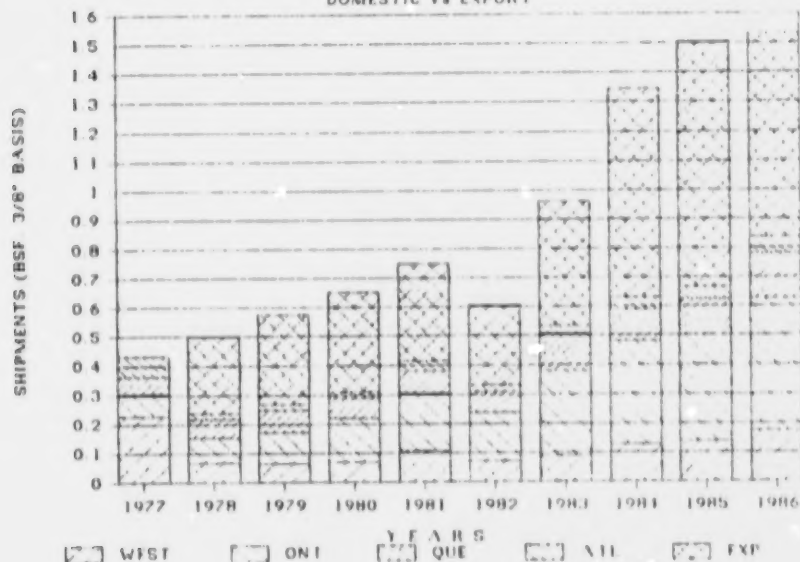
WAFERBOARD SHIPMENTS - CANADA
DOMESTIC vs EXPORT

Figure 3-5
 WAFERBOARD SHIPMENTS - CANADA
 BY REGION

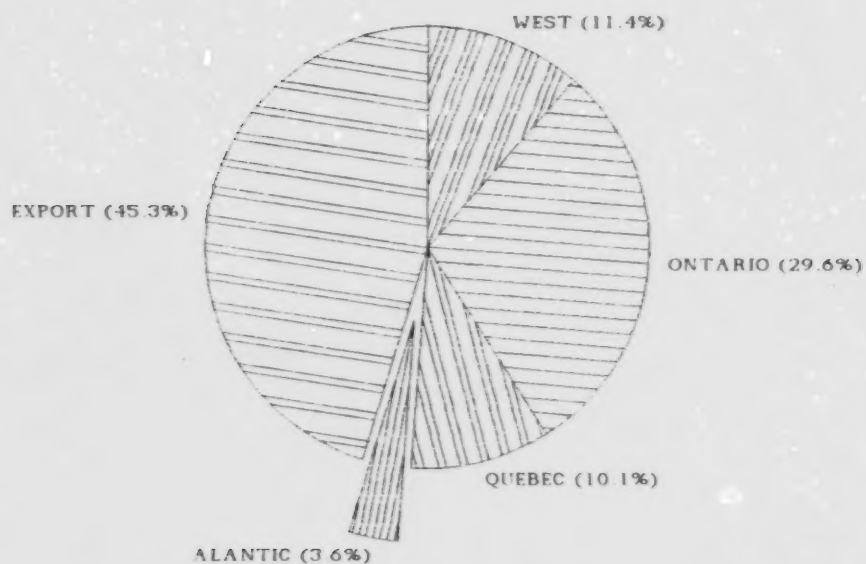
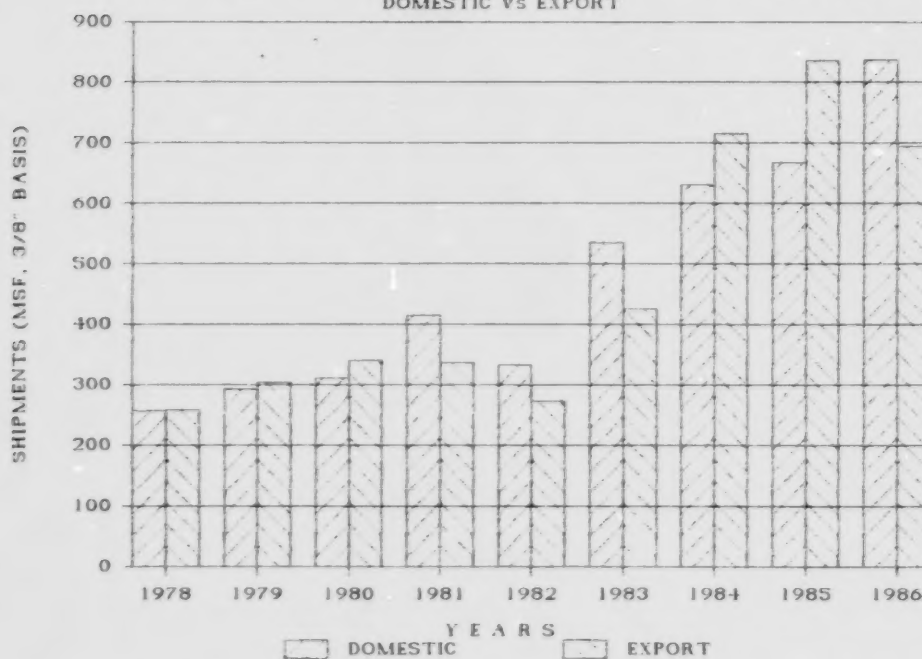


Figure 3-6
 WAFERBOARD SHIPMENTS - CANADA
 DOMESTIC vs EXPORT



3.3 Canada - Total Shipments, Plywood, and Waferboard

With the exception of 1982, total shipments of structural panels have been steady, in the 3.1 to 3.7 billion sf/year range. Today's level of domestic shipments of 2.66 billion sf/year is not much higher than 1978's level of 2.60 billion sf/year. Exports, mainly to the United States have doubled from 465 million sf/year to approximately 1 billion sf/year.

Figure 3-7

PLYWOOD & WAFERBOARD - C A N A D A

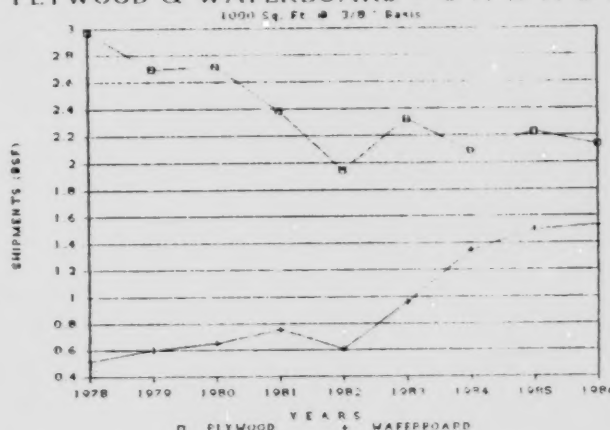


Table 3-3

CANADA

PLYWOOD & WAFERBOARD , PRODUCTION & SHIPMENTS (Millions Sq.Ft. @ 3/8" Basis)

YEAR	PRODUCTION	SHIPMENTS	WEST	ONTARIO	QUEBEC	ATLANTIC PROVINCES	DOMESTIC	EXPORT
----	-----	-----	----	-----	-----	-----	-----	-----
1978	3,433.4	3,485.7	1,270.7	655.5	532.6	145.7	2,604.5	833.2
1979	3,480.7	3,293.0	1,213.4	586.7	500.5	159.5	2,460.1	832.8
1980	3,258.0	3,368.8	1,240.9	642.1	467.6	146.6	2,497.2	869.5
1981	3,140.8	3,136.0	1,217.4	617.9	401.9	141.8	2,379.0	757.0
1982	2,457.0	2,548.2	892.2	496.5	371.2	101.5	1,861.4	686.8
1983	3,307.8	3,286.4	1,023.2	711.1	513.2	143.8	2,391.4	895.1
1984	3,431.5	3,431.5	876.1	787.2	475.1	144.9	2,283.3	1,148.1
1985	3,724.0	3,730.7	927.2	891.5	517.1	145.8	2,481.6	1,249.1
1986	3,643.9	3,664.9	923.2	1,015.7	560.9	160.1	2,659.9	1,005.0

3.4 USA - Total Shipments - Plywood and Waferboard

United States consumption of structural panel products has fluctuated from a low of 15.6 billion sf/year in 1981 and 1982, to a high of 23.7 billion sf in 1986. This high is only 17% higher than 1978's level of 20.2 billion sf. 1978 also represented the year housing starts reached a level of just over 2 million. By comparison, 1986 starts were 1,806,000 units/year.

Waferboard's share of the structural panel market has increased dramatically, representing 18% of the United States panel market in 1986. Waferboard and plywood figures represent apparent consumption which includes imports from Canada.

Table 3-4

CANADA

PLYWOOD & WAFERBOARD , PRODUCTION & SHIPMENTS
(Millions Sq.Ft. @ 3/8" Basis)

YEAR	WAFERBOARD SHIPMENTS	PLYWOOD SHIPMENTS	TOTAL SHIPMENTS	% WAFERBOARD
1977	433.5	2,703.8	3137.3	13.8%
1978	516.1	2,969.6	3485.7	14.8%
1979	597.2	2,695.8	3293.0	18.1%
1980	651.5	2,717.3	3368.8	19.3%
1981	751.5	2,384.5	3136.0	24.0%
1982	605.7	1,942.5	2548.2	23.8%
1983	961.8	2,324.7	3286.4	29.3%
1984	1,346.5	2,085.0	3431.5	39.2%
1985	1,504.1	2,226.5	3730.7	40.3%
1986	1,531.9	2,133.1	3664.9	41.8%

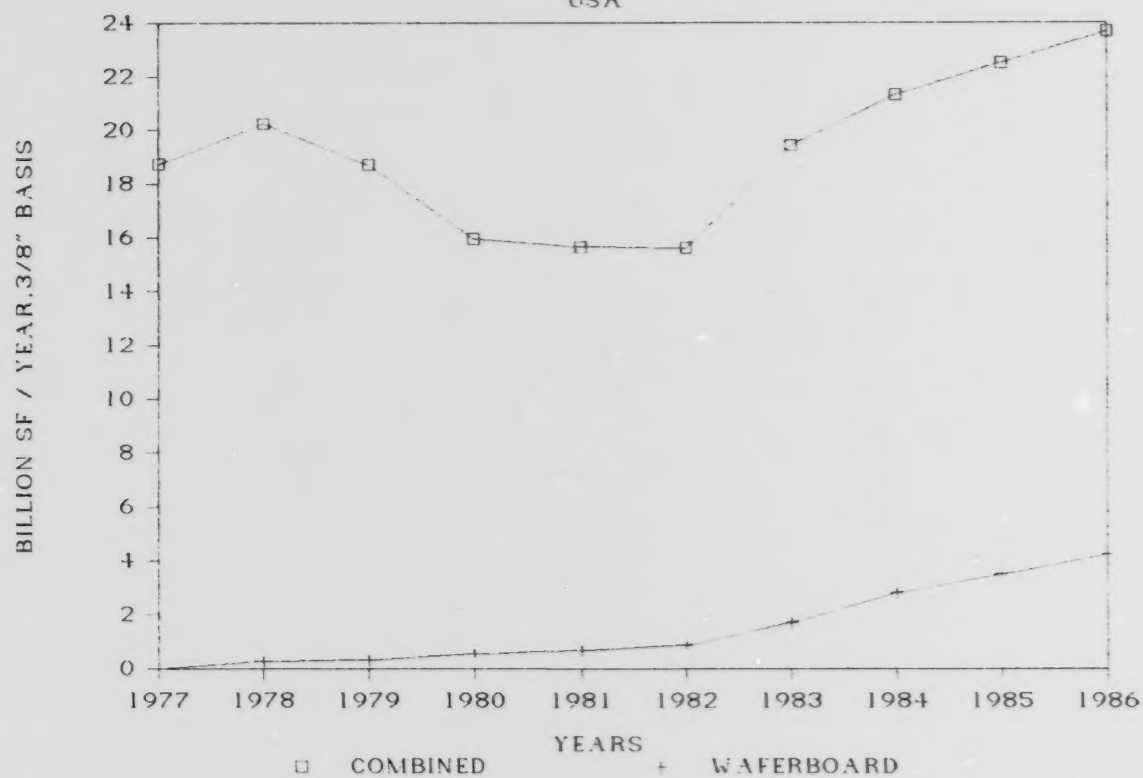
Table 3-5

UNITED STATES

PLYWOOD & WAFERBOARD CONSUMPTION

YEAR	SOFTWOOD PLYWOOD	WAFERBOARD	PLYWOOD & WAFERBOARD	% WAFERBOARD
1978	19980	259	20239	1.3%
1979	18405	304	18709	1.6%
1980	15415	536	15951	3.4%
1981	14982	678	15660	4.3%
1982	14741	870	15611	5.6%
1983	17738	1706	19444	8.8%
1984	18525	2803	21328	13.1%
1985	18994	3505	22499	15.6%
1986	19436	4240	23676	17.9%

Figure 3-8
PLYWOOD & WAFERBOARD CONSUMPTION
USA



SISKIN MANAGEMENT INC.

WAFFERBOARD/OSB FACILITYMARKETING FEASIBILITY STUDY, PHASE IINORTH WESTERN NEW BRUNSWICK4 STRUCTURAL PANEL INDUSTRY CAPACITY4.1 United States

The United States structural panel industry achieved peak production levels in 1978, with 182 mills producing 19,964 million sf (3/8" basis). In 1982, the industry went through a recession with 164 mills producing 16,403 million sf. Since then, production has risen to 25,633 million sf, with 166 mills operating. The average production per unit has increased dramatically from 80 million sf per unit in 1970, to 154 million sf per unit in 1986, a 193% increase per mill in actual production. The industry has seen a tremendous increase in production with fewer mills due to technological changes combined with new methods to increase production rates and wood utilization. Low cost efficient producers have replaced high cost/low volume output mills during economic downturns. New concepts such as high moisture content gluing, combined with lower energy and manpower costs have helped to keep the industry competitive.

The American Plywood Association states that the Structural Panel Industry has historically added capacity in sizeable chunks during strong demand markets and learned to suffer overcapacity indigestion when the market slows.

The American Plywood Association predicts that the United States structural panel industry will operate at 80% capacity through the next 5 years.

Table 4-1

Structural Panel Industry, Operating Rates(%)1986-1991

<u>Year</u>	<u>West</u>	<u>Inland</u>	<u>South</u>	<u>North</u>	<u>Total</u>
1986	77	74	92	106	86
1987	74	69	87	94	81
1988	75	71	85	92	80
1989	74	71	82	94	79
1990	78	71	82	96	81
1991	80	70	83	92	81

4.2 Structural Panel Industry Capacity - Waferboard/OSB

The North American waferboard/OSB industry has grown steadily since 1978, with total current operating plant production capacity at approximately 6.4 billion square feet (on a 3/8" basis) per year. This represents an industry capacity compound growth rate of 24% per year from 1978 to 1987. Presently, additional plant capacity of 1.875 billion square feet per year is under construction or has been announced.

The list of all waferboard plants presently operating under construction, or announced for both Canada and the USA is shown in the next two tables.

Table 4-2		
Waferboard/OSB Plants - Canada Present and Planned Capacity Million sf, 3/8" Basis		
Present Operating Plants	Location	Capacity
MacMillan-Bloedel	Hudson Bay, Saskatchewan	200
MacMillan-Bloedel	Thunder Bay, Ontario	170
Waferboard Corporation	Timmins, Ontario	100
Weldwood of Canada	Long Lac, Ontario	150
JH Normick Inc.	LaSarre, Quebec	100
Weldwood of Canada Ltd.	Slave Lake, Alberta	150
Waferboard Corporation	St. George de Champlain, Quebec	160
Grant Waferboard	Englehart, Ontario	200
Forpan	Val d'Or, Quebec	180
Pelican	Edson, Alberta	260
Sturdi-Board	Drayton Valley, Alberta	260
Atlantic Waferboard	Chatham, N.B.	186
Louisiana-Pacific	Dawson Creek, B.C.	260
Total Canadian Production		2,376
Planned Plants Under Construction		
Normick Perron Inc.	Chambord, Quebec	260
Grant Waferboard	Englehart, Ontario	300
Total Canadian Under Construction/Planned		560
TOTAL CANADA (Capacity, msf/yr, 3/8" basis)		2,936

Table 4-3

Waferboard/OSB Plants - United States
Present and Planned Capacity
Million sf, 3/8" Basis

Present Operating Plants	Location	Capacity
Blandin Wood Products	Grand Rapids, Minnesota	285
L.P. Corporation	Hayward, Wisconsin	320
G.P. Corporation	Woodland, Maine	170
Potlatch Paper	Cook, Minnesota	170
Elmendorf	Claremont, New Hampshire	80
Northwood Panelboard	Bemidji, Minnesota	240
L.P. Corporation	Houlton, Maine	160
Potlatch Paper	Bemidji, Minnesota	180
Weyerhaeuser Company	Grayling, Michigan	300
J.M. Huber Corporation	Easton, Maine	160
Martco	LeMoyen, Louisiana	170
L.P. Corporation	Corrigan, Texas	140
G.P. Corporation	Dudley, North Carolina	120
L.P. Corporation	Chilco, Idaho	90
L.P. Corporation	Montrose, Colorado	90
L.P. Corporation	Kremmling, Colorado	90
L.P. Corporation	Two Harbors, Minnesota	90
L.P. Corporation	Urania, Louisiana	120
G.P. Corporation	Grenada, Mississippi	250
G.P. Corporation	Skippers, Virginia	250
L.P. Corporation	Dungannon, Virginia	90
I.P. Company	Nacogdoches, Texas	190
L.P. Corporation	New Waverly, Texas	90
Weyerhaeuser	Elkin, North Carolina	170
Total US Production		<u>4,015</u>
Under Construction		
L.P. Corporation	Sagola, Michigan	260
Langboard	Valdosta, Georgia	<u>135</u>
Total US Under Construction		395
Planned Plants		
G.P. Corporation	Beaver Marshes, Oregon	230
G.P. Corporation	Glade Springs, Virginia	230
Weyerhaeuser	Klamath Falls, Oregon	200
L.P. Corporation	Athens, Georgia (1989)	<u>260</u>
Total US Planned		<u>920</u>
TOTAL US (Capacity, msf/yr 3/8" basis)		5,330

SISKIN MANAGEMENT INC.
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MARKETING FEASIBILITY STUDY, PHASE II
NORTH WESTERN NEW BRUNSWICK

5 STRUCTURAL PANEL - DEMAND BY END USE

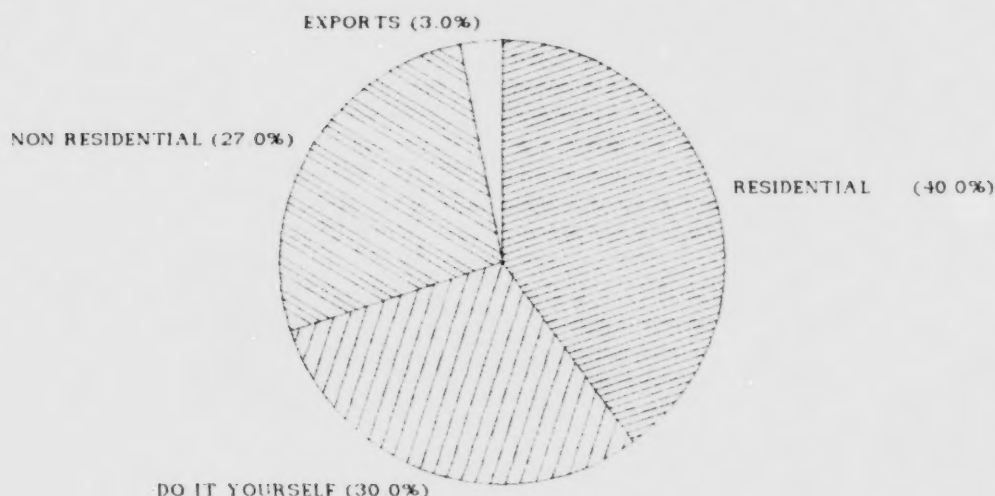
5.1 Introduction

The United States market for structural panel products can be divided into four major categories. These categories, with the approximate market share are shown below:

Table 5-1 Structural Panel Demand By End Use					
	R.I.S.	Plywood & Panel	U.S. Ind. Outlook	APA	USE
Residential and New	42.0%	40%	40%	37%	40%
Repair and Remodeling	30.5%	28%	36%	27%	30%
Non Residential	25.5%	-	-	33%	27%
Exports	02.0%	2%	-	3%	3%

Other factors play a part in affecting demand levels for structural panel products. Factors include population levels and trends, age distribution, household formations, levels of housing starts, age of housing stocks, levels of disposable income, consumer price index, etc.

Figure 5-1
STRUCTURAL PANEL MARKET-USA
MARKET SHARE



Factors affecting each of these four major areas are presented in sections 5.2 to 5.5.

5.2 Residential Construction

Directly or indirectly, the level of new home construction, and repairs and alterations to existing houses accounts for approximately 70% of all structural panel consumption.

The majority of structural panels used in new home construction is used for wall and roof sheathing, and for sub flooring. Plywood sheathing (1/2" CDX) has replaced lumber as the major cladding material for homes. Waferboard (7/16") has replaced plywood to some extent for wall and roof sheathing.

Historical levels of housing starts for Canada range from 203,300 (1977) to a low of 125,800 units in 1982. United States starts ranged from 1,062,000 starts in 1982 to 2,020,000 starts in 1978. Current levels of 1,631,000 (USA) and 189,500 (Canada) are close to ten year highs.

Table 5-2

HOUSING STARTS , NORTH AMERICA

1974 - 2005

	U.S.A. -----	CANADA -----	TOTAL -----
1974	1,338,000	169,300	1,507,300
1975	1,160,000	181,700	1,341,700
1976	1,538,000	209,700	1,747,700
1977	1,988,000	203,300	2,191,300
1978	2,020,000	178,600	2,198,600
1979	1,745,000	151,900	1,896,900
1980	1,292,000	125,030	1,417,030
1981	1,084,000	142,441	1,226,441
1982	1,062,000	125,800	1,187,800
1983	1,703,000	162,600	1,865,600
1984	1,749,000	134,900	1,883,900
1985	1,743,000	165,900	1,908,900
1986	1,806,000	199,800	2,005,800
1987	1,631,000	189,500	1,820,500
1988	1,601,000	193,600	1,794,600
1989	1,617,000	183,500	1,800,500
1990	1,657,000	166,000	1,823,000
1991	1,665,000	177,400	1,842,400
1992	1,632,000	169,200	1,801,200
1993	1,514,000	165,700	1,679,700
1994	1,433,000	162,700	1,595,700
1995	1,407,000	160,000	1,567,000
1996	1,350,000	159,500	1,509,500
1997	1,350,000	145,100	1,495,100
1998	1,350,000	159,200	1,509,200
1999	1,350,000	159,500	1,509,500
2000	1,350,000	160,000	1,510,000
2001	1,202,000	160,500	1,362,500
2002	1,202,000	147,200	1,349,200
2003	1,202,000	161,700	1,363,700
2004	1,202,000	162,200	1,364,200
2005	1,202,000	162,600	1,364,600

SOURCE: National Association of Home Builders,
Informetrica Limited

5.2.1 Regional Housing Starts - USA

Graphs show the historical and projected housing starts for the four census regions of the United States. Projections were purchased from the National Association of Home Builders.

Figure 5-2

HOUSING STARTS - WEST
U.S.A.

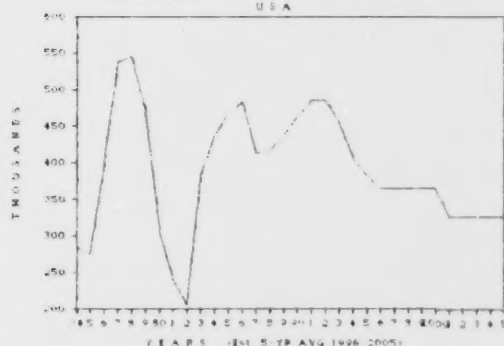


Figure 5-3

HOUSING STARTS - N.C.
U.S.A.

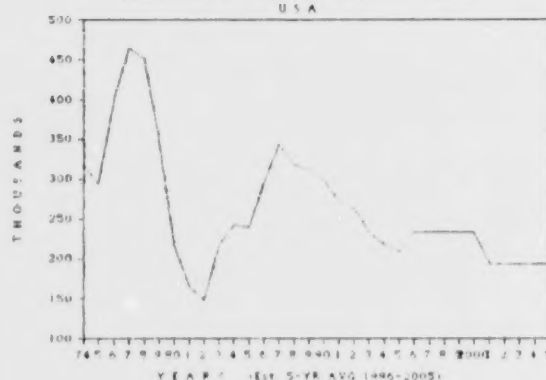


Figure 5-4

HOUSING STARTS - SOUTH
U.S.A.

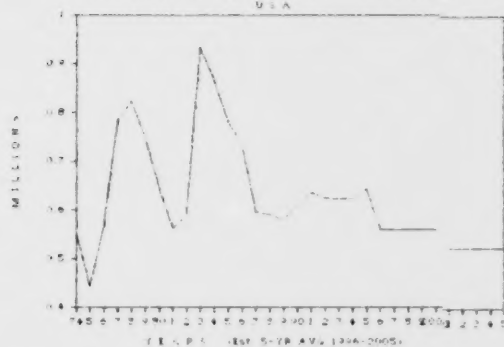


Figure 5-5

HOUSING STARTS - N.E.
U.S.A.

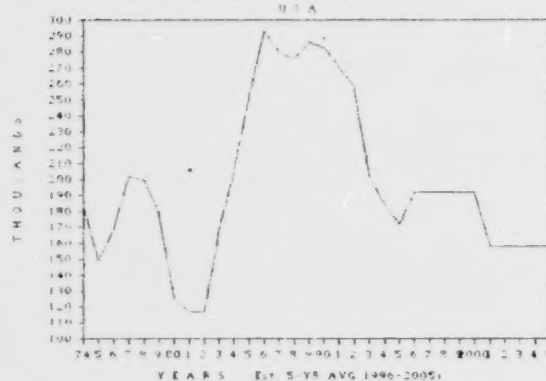


TABLE 5-3

TOTAL HOUSING STARTS - U.S.A.
(Thousands)

YEAR	NORTH EAST			MID WEST			SOUTH			WEST			TOTAL U.S.A.		
	SINGLE FAMILY	MULTI FAMILY	NORTH EAST TOTAL	SINGLE FAMILY	MULTI FAMILY	MID WEST TOTAL	SINGLE FAMILY	MULTI FAMILY	SOUTH TOTAL	SINGLE FAMILY	MULTI FAMILY	WEST TOTAL	SINGLE FAMILY	MULTI FAMILY	U.S.A. TOTAL
1974	119	64	183	225	92	317	367	186	553	176	109	285	887	451	1338
1975	112	37	149	222	72	294	366	76	442	192	83	275	892	268	1160
1976	127	42	169	294	106	400	464	105	569	277	123	400	1162	376	1538
1977	156	46	202	337	128	465	588	195	783	370	168	538	1451	537	1988
1978	147	53	200	325	126	451	604	220	824	358	187	545	1434	586	2020
1979	123	55	178	243	106	349	522	226	748	306	164	470	1194	551	1745
1980	87	38	125	142	76	218	428	215	643	196	110	306	853	439	1292
1981	84	33	117	110	55	165	363	199	562	148	92	240	705	379	1084
1982	79	38	117	99	50	149	357	234	591	127	78	205	662	400	1062
1983	123	45	168	153	65	218	557	378	935	234	148	382	1067	636	1703
1984	158	46	204	167	76	243	528	338	866	230	206	436	1083	666	1749
1985	182	70	252	148	92	240	504	278	782	239	230	469	1073	670	1743
1986	227	66	293	188	108	296	503	230	733	261	223	484	1179	627	1806
1987	220	60	280	240	103	343	438	157	595	254	159	413	1152	479	1631
1988	218	58	276	222	96	318	430	160	590	259	158	417	1129	472	1601
1989	222	64	286	218	95	313	417	163	580	284	154	438	1141	476	1617
1990	224	59	283	205	94	299	430	183	613	295	167	462	1154	503	1657
1991	221	50	271	180	93	273	441	194	635	304	182	486	1146	519	1665
1992	212	46	258	175	89	264	441	183	624	303	183	486	1131	501	1632
1993	160	42	202	158	76	234	451	171	622	294	162	456	1063	451	1514
1994	148	36	184	144	74	218	456	168	624	256	151	407	1004	429	1433
1995	139	33	172	137	73	210	480	163	643	236	146	382	992	415	1407
1996	154	38	192	163	71	234	422	137	559	220	145	365	959	391	1350
1997	154	38	192	163	71	234	422	137	559	220	145	365	959	391	1350
1998	154	38	192	163	71	234	422	137	559	220	145	365	959	391	1350
1999	154	38	192	163	71	234	422	137	559	220	145	365	959	391	1350
2000	133	25	158	137	57	194	411	113	524	208	118	326	889	313	1202
2001	133	25	158	137	57	194	411	113	524	208	118	326	889	313	1202
2002	133	25	158	137	57	194	411	113	524	208	118	326	889	313	1202
2003	133	25	158	137	57	194	411	113	524	208	118	326	889	313	1202
2004	133	25	158	137	57	194	411	113	524	208	118	326	889	313	1202
2005	133	25	158	137	57	194	411	113	524	208	118	326	889	313	1202

5.2.1.1 Factors Influencing Housing Starts

In the short term, housing start projections are influenced by interest rates, and consumer spending trends; in the long term, demographics take over. Prior to 1986, United States starts peaked in 1978 at approximately 2,000,000 units. Starts dropped to 1,292,000 in 1980, due to a 2 quarter mini recession. Housing starts remained at record lows in 1981 - 1982, at 1,084,000 and 1,062,000 units, due to a 5 quarter mini recession. Since then, housing starts have rebounded to levels of 1.7 - 1.8 million per year.

The National Association of Home Builders (NAHB) takes the normal volume approach to long range projection. They use the level of 1.65 million starts as a measure of normal volume at this time. (1987 starts are projected at 1.63 million starts). Prior to 1986, pent up demand was being satisfied, with 1986 levels of 1.8 million starts above normal demand. NAHB long term projections do not show peaks.

By comparison, the American Plywood Association projections for housing starts for the next five years are a little more aggressive.

Figure 5-6

HOUSING STARTS - U.S.A. & CANADA

(Estimated Avg for USA 1996-2005)

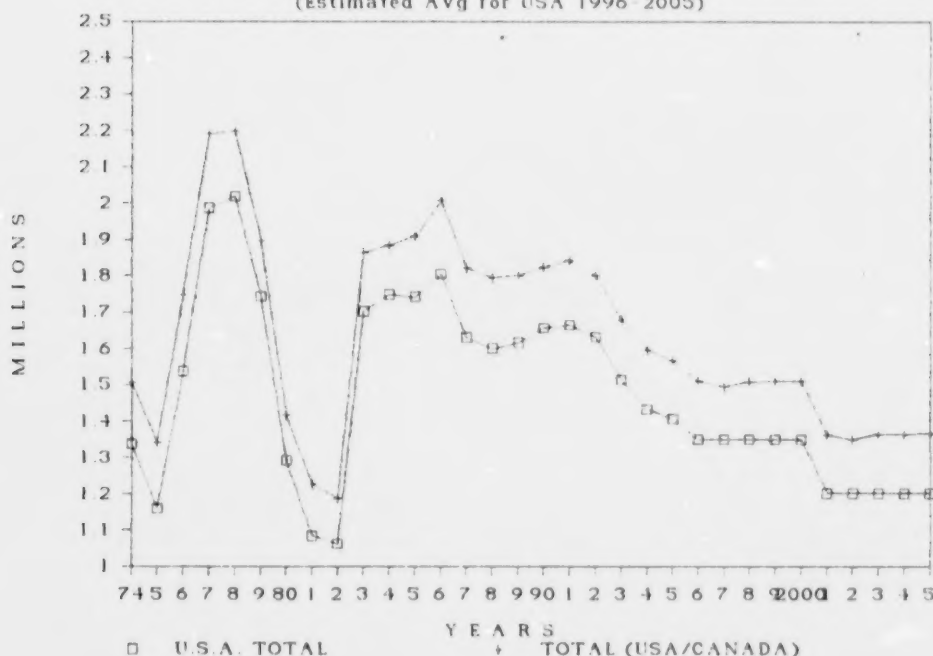


Table 5-4

NAHB vs APA Projections
United States Housing Starts
1987 - 1991

Year	NAHB	APA	% Difference
1987	1,631,000	1,650,000	+ 1.2%
1988	1,601,000	1,650,000	+ 3.1%
1989	1,617,000	1,700,000	+ 5.1%
1990	1,657,000	1,800,000	+ 8.6%
1991	1,665,000	1,850,000	+11.1%

Even though the American Plywood Association projections are higher, they show a reasonable cyclical pattern. In reviewing APA's numbers, the NAHB said that the NAHB figures were: a) reasonable, and b) good planning numbers. Over the next 5 years, 1.6 to 1.7 million starts are highly likely, with long term levels of 1.1 to 1.2 million starts very possible.

5.2.1.2 Housing Formation Rates

NAHB projections are based on demographics, and use supporting data from: a) the Housing Futures Program of the Joint Center for Housing Studies by Harvard and MIT and b) the United States Census Bureau. Demographics and population projections are used by both Harvard/MIT and the United States Census Bureau. A summary of housing formation rates from the period 1970 - 2000 is shown for each.

Table 5-5		
Housing Formation Rates, USA 1970 - 2000		
Year	Harvard/MIT	US Census Bureau
1970-1975		1,544,000
1975-1980		1,597,000
1980-1985		1,203,000
1985-1990	1,490,000	1,416,000
1990-1995	1,207,000	1,214,000
1995-2000	1,082,000	1,122,000

NAHB calculates levels of housing starts as follows (simplified calculation):

Table 5-6	
Sample Calculation Housing Starts, 1995-2000	
Component	Housing Starts
1995 - 2000 Housing Formation Rates	1,082,000
Add: Vacancy rate, 0.07% of 100 million stock	70,000
Add: Loss from stock (fire; broken into smaller units, etc.)	200,000
Total Housing Starts	1,352,000

5.2.1.3 Population Projections

The outlook for household formations is greatly influenced by population projections. A recent article published in *Housing Economics*, studies the effect of housing formations by population trends, and family/household formations. See Appendix 1.

Population projections for the United States, showing distribution by Census regions is shown below. Population trends are also shown for each area.

Figure 5-7

POPULATION DISTRIBUTION, BY REGION

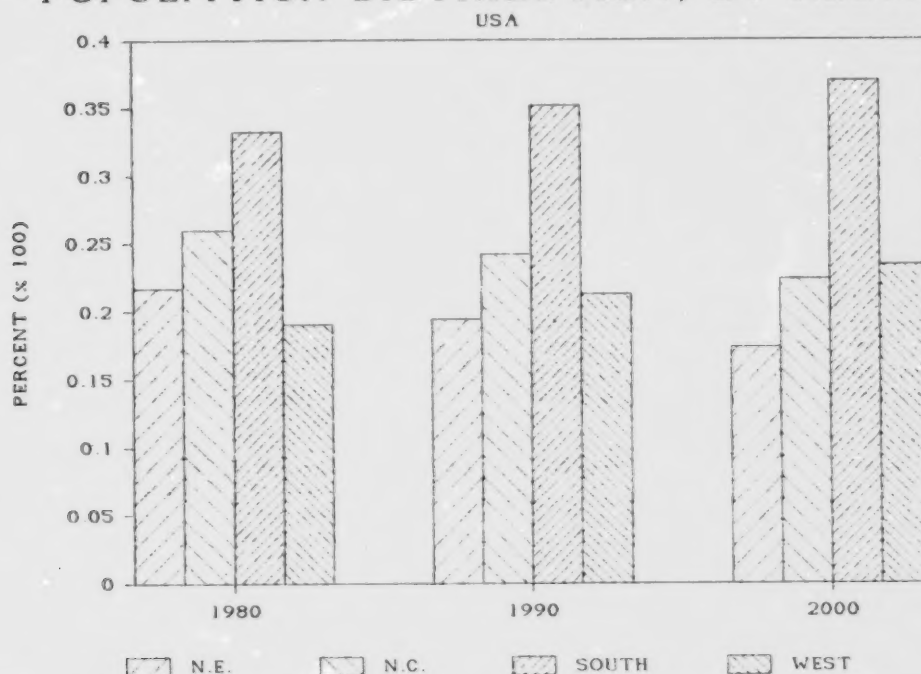


Table 5-7

POPULATION PROJECTIONS
USA

	1980	1990	2000
Northeast	49,136,700	48,423,300	46,400,600
North Central	58,853,800	60,265,400	59,714,000
South	75,349,200	87,594,200	98,827,800
West	43,165,200	52,920,200	62,519,200
Total	226,504,900	249,203,100	267,461,600

Source: US Census

5.2.1.4 Correlation, Housing Starts vs Plywood Shipments, USA

Through regression analysis, it is possible to test the correlation between the number of housing starts, and the level of structural panel shipments. The measure of strength of linear relationship between the two variables is called the correlation coefficient. A correlation coefficient of zero indicates no correlation, while a coefficient of -1 or +1 indicates perfect negative or positive correlations.

United States historical levels of housing starts versus total structural panel shipments (plywood and waferboard) are shown below. Projections for 1987 - 2005 are based on the historical correlation.

The first correlation test was done comparing housing starts in the United States, versus plywood shipments. With a correlation of 0.93, there is a strong relationship between the level of housing starts and the level of plywood shipments.

Table 5-8

HOUSING STARTS vs PLYWOOD SHIPMENTS
MILLIONS Sq.Ft. @ 3/8" Basis

YEAR	TOTAL CANHS	TOTAL PLYWOOD ESTIMATE	USA TOTAL USAHS	USA TOTAL PLYWOOD ESTIMATE	CANADA -----
1977	203,300	2,129	2,073 1,988,000	18,748	19,670
1978	178,600	2,347	2,002 2,020,000	19,980	19,841
1979	151,900	2,167	1,926 1,745,000	18,405	18,369
1980	125,030	2,186	1,850 1,292,000	15,415	15,946
1981	142,441	1,964	1,899 1,084,000	14,982	14,833
1982	125,800	1,528	1,852 1,062,000	14,741	14,715
1983	162,600	1,855	1,957 1,703,000	17,738	18,145
1984	134,900	1,652	1,878 1,749,000	18,525	18,391
1985	165,900	1,814	1,966 1,743,000	18,994	18,359
1986	199,800	1,823	2,063 1,806,000	19,436	18,696
		PROJ		PROJ	USA
1987	189,500	2,033	1,631,000	17,760	Regression Output:
1988	193,600	2,045	1,601,000	17,599	Constant 9033.0123
1989	183,500	2,016	1,617,000	17,685	Std Err of Y Est 537.28392
1990	166,000	1,966	1,657,000	17,899	R Squared 0.9311209
1991	177,400	1,999	1,665,000	17,941	No. of Observations 10
1992	169,200	1,976	1,632,000	17,765	Degrees of Freedom 8
1993	165,700	1,966	1,514,000	17,134	
1994	162,700	1,957	1,433,000	16,700	X Coefficient(s) 0.0053504
1995	160,000	1,946	1,407,000	16,561	Std Err of Coef. 0.0005144
1996	159,500	1,948	1,350,000	16,256	
1997	145,100	1,907	1,350,000	16,256	
1998	159,200	1,947	1,350,000	16,256	
1999	159,500	1,948	1,350,000	16,256	
2000	160,000	1,949	1,350,000	16,256	
2001	160,500	1,951	1,202,000	15,464	
2002	147,200	1,913	1,202,000	15,464	
2003	161,700	1,954	1,202,000	15,464	
2004	162,200	1,956	1,202,000	15,464	
2005	162,600	1,957	1,202,000	15,464	

Table 5-9

HOUSING STARTS vs PLYWOOD + WAFERBOARD SHIPMENTS
MILLIONS Sq.Ft. @ 3/8" Basis

	CANHS	CANPLWF	USHS	USWSHPMTS
	ESTIMATE			
1978	178,600	2,605	2560	2,020,000
1979	151,900	2,460	2388	1,745,000
1980	125,030	2,497	2215	1,292,000
1981	142,441	2,379	2327	1,084,000
1982	125,800	1,861	2220	1,062,000
1983	162,600	2,391	2457	1,703,000
1984	134,900	2,283	2278	1,749,000
1985	165,900	2,482	2478	1,743,000
1986	199,800	2,660	2696	1,806,000
		PROJ		PROJ
1987	189,500	2,630		1,631,000
1988	193,600	2,656		1,601,000
1989	183,500	2,591		1,617,000
1990	166,000	2,479		1,657,000
1991	177,400	2,552		1,665,000
1992	169,200	2,499		1,632,000
1993	165,700	2,477		1,514,000
1994	162,700	2,457		1,433,000
1995	160,000	2,440		1,407,000
1996	159,500	2,437		1,350,000
1997	145,100	2,344		1,350,000
1998	159,200	2,435		1,350,000
1999	159,500	2,437		1,350,000
2000	160,000	2,440		1,350,000
2001	160,500	2,443		1,202,000
2002	147,200	2,358		1,202,000
2003	161,700	2,451		1,202,000
2004	162,200	2,454		1,202,000
2005	162,600	2,457		1,202,000

CANADA

Regression Output:

Constant	1409.9468
Std Err of Y Est	178.79528
R Squared	0.4835512
No. of Observations	9
Degrees of Freedom	7

X Coefficient(s)	0.0064376
Std Err of Coef.	0.0025146

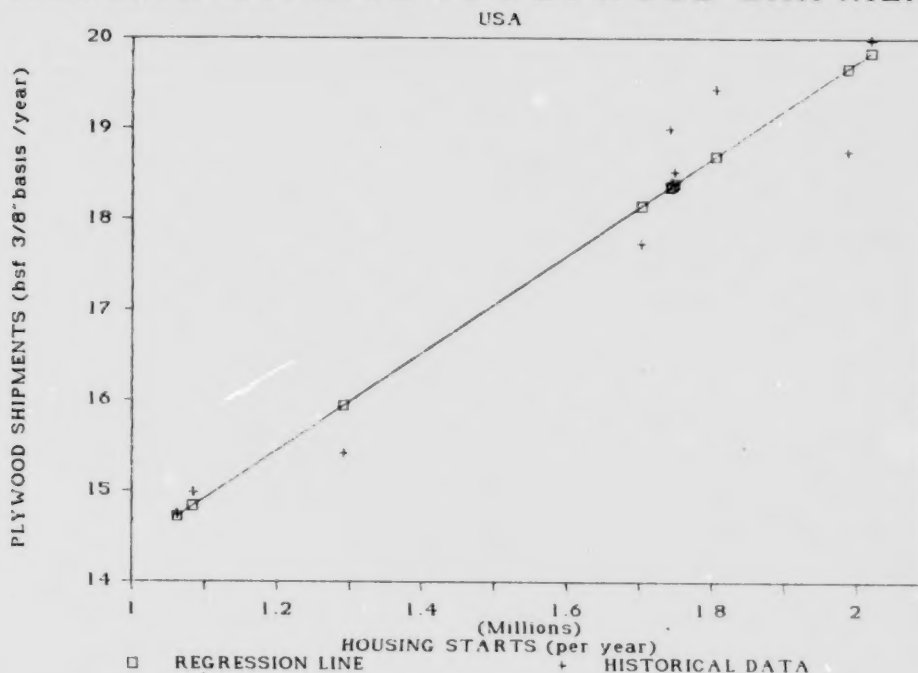
U.S.A.

Regression Output:

Constant	9259.0116
Std Err of Y Est	1999.9393
R Squared	0.5616254
No. of Observations	10
Degrees of Freedom	8

X Coefficient(s)	0.0061311
Std Err of Coef.	0.0019151

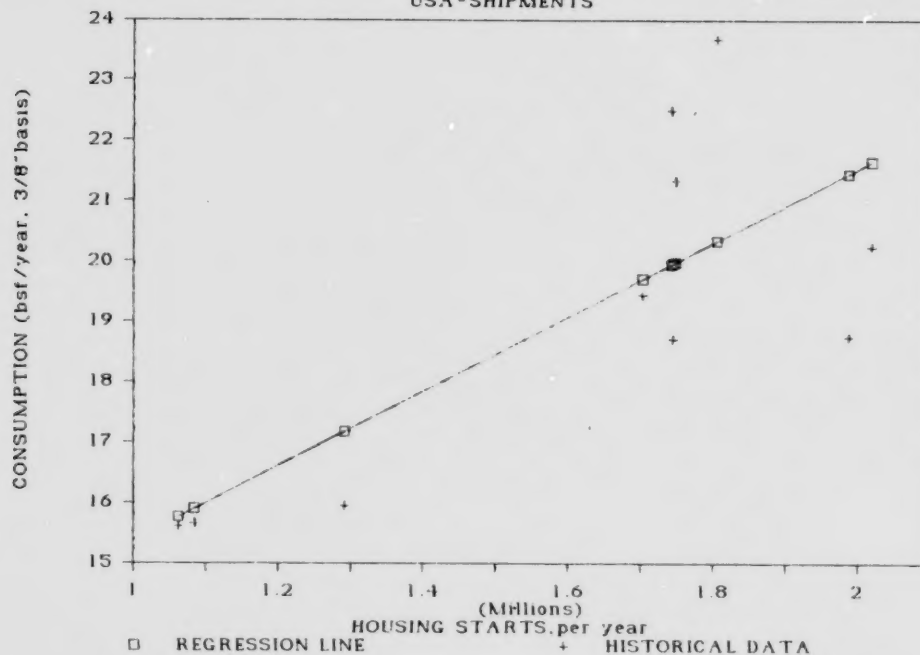
Figure 5-8
HOUSING STARTS vs PLYWOOD SHIPMENTS



5.2.1.5 Correlation, Housing Starts vs Plywood and Waferboard Shipment, USA

The second correlation test shows total structural panel shipments, softwood plywood and waferboard, versus United States housing starts. The correlation coefficient dropped from 0.93 (plywood only) to 0.56. It can be inferred from this, that with the addition of waferboard to the panel shipments, the degree of dependency drops significantly, therefore the usage of waferboard is not as directly affected by levels of housing starts. It also confirms our research in the market place, that a considerable amount of waferboard is consumed in non-new housing applications.

Figure 5-9
HOUSING STARTS vs PLYWOOD + WAFERBOARD
USA - SHIPMENTS



5.2.2 Regional Housing Starts - Canada

Graphs show the historical and projected housing starts for the four geographical regions of Canada, West, Ontario, Quebec, and the Atlantic Provinces. Projections were purchased from Informetrica Inc. (Ottawa).

Figure 5-10

HOUSING STARTS - WEST



Figure 5-11

HOUSING STARTS - ONTARIO

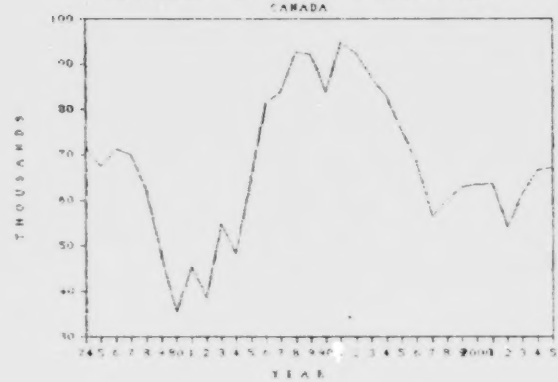


Figure 5-12

HOUSING STARTS - QUEBEC

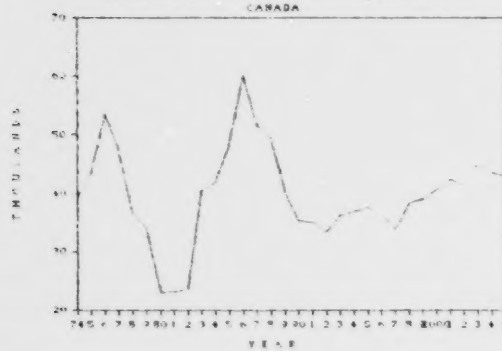


Figure 5-13

HOUSING STARTS - ATLANTIC PROV.

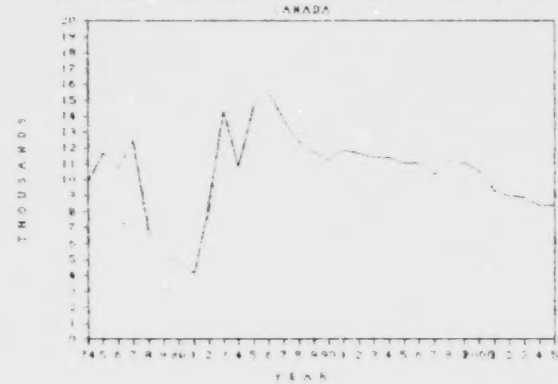


Table 5-10

HOUSING STARTS , CANADA

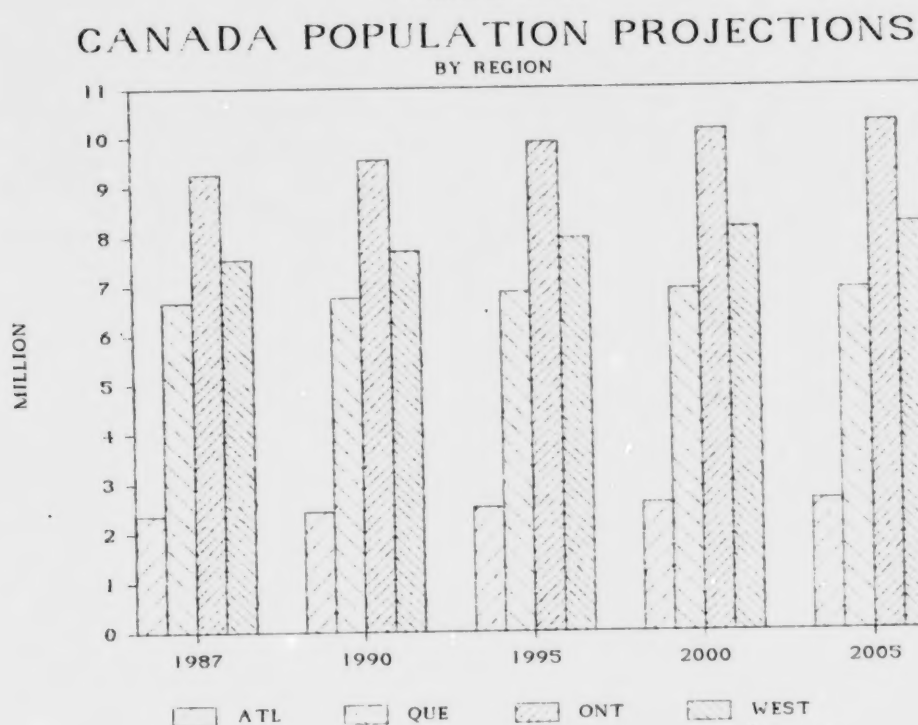
1974 - 2005

YEAR	WEST	ONTARIO	QUEBEC	ATLANTIC	TOTAL
----	----	-----	-----	-----	-----
1974	48500	71500	39400	9900	169300
1975	59300	67600	43100	11700	181700
1976	74100	71300	53500	10800	209700
1977	73000	70200	47600	12500	203300
1978	73600	61900	36600	6500	178600
1979	64400	47800	34000	5700	151900
1980	61802	35432	23064	4732	125030
1981	69762	45399	23121	4159	142441
1982	55400	38500	23500	8400	125800
1983	53000	54900	40300	14400	162600
1984	34000	48200	41900	10800	134900
1985	38300	64900	48000	14700	165900
1986	42400	81500	60300	15600	199800
1987	40300	83900	51500	13800	189500
1988	39000	92700	49500	12400	193600
1989	39200	92200	40300	11800	183500
1990	35600	83800	35300	11300	166000
1991	35600	94800	35100	11900	177400
1992	31700	92400	33400	11700	169200
1993	30700	87200	36300	11500	165700
1994	31600	82800	36900	11400	162700
1995	35800	75400	37700	11100	160000
1996	43500	68500	36400	11100	159500
1997	44300	56500	33900	10400	145100
1998	49400	60300	38300	11200	159200
1999	46400	63000	39000	11100	159500
2000	45300	63500	40600	10600	160000
2001	45200	63700	42300	9300	160500
2002	42700	54100	41400	9000	147200
2003	46000	61700	45100	8900	161700
2004	43500	66800	43500	8400	162200
2005	43900	67300	43000	8400	162600

5.2.2.1 Population Projections

Population projections for Canada, broken down by major geographic regions is shown below. Population trends are also shown for each area.

Figure 5-14



Source: Statistics Canada, 91-520

5.2.2.2 Correlation, Housing Starts Versus Panel Shipments - Canada

As with the United States, the level of Canadian panel shipments versus housing starts was compared. The analysis shows that there is a weak correlation between housing starts and panel shipments in Canada. Actual correlation data is found in section 5.2.1.4 and 5.2.1.5.

Figure 5-15

HOUSING STARTS vs PLYWOOD

CANADA - SHIPMENTS

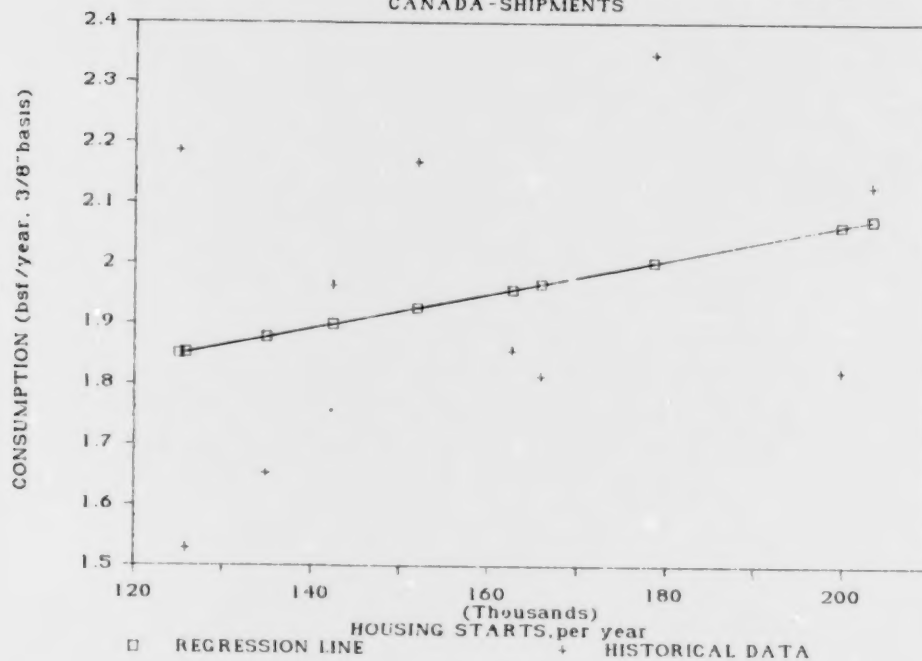


Figure 5-16

H.STARTS vs PLYWOOD & WAFERBOARD/OSB

CANADA - SHIPMENTS

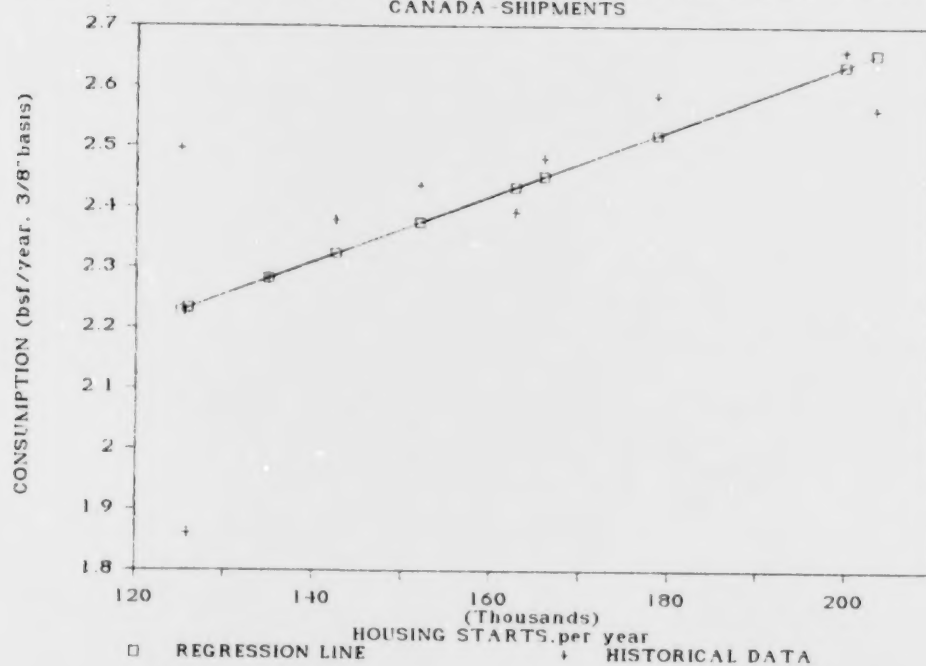
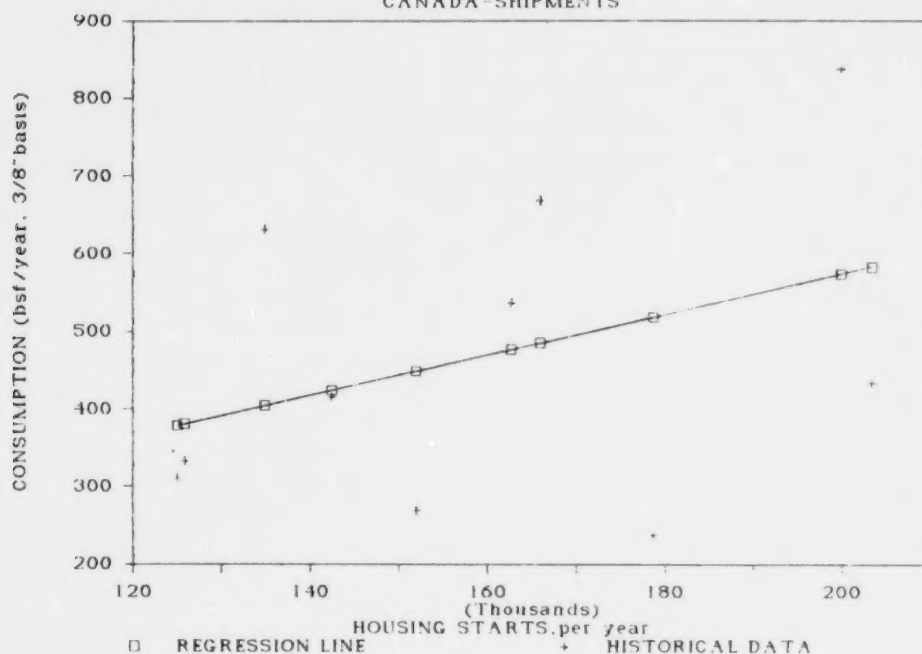


Figure 5-17
HOUSING STARTS vs WAFERBOARD/OSB
CANADA-SHIPMENTS



5.2.3 Panel Demand - New Residential Construction

Several factors affect the amount of structural panel products used in home construction. Key factors include the actual number of starts (section 5-2); the size of the units; the type of units, single family versus multi family or mobile homes; and the amount of panel products used for sheathing, versus lumber.

Many persons contacted during our survey felt that consumers were building higher quality, more expensive homes, and they were being more selective in choosing building materials. It was noted many times that consumers perceive that buildings built with waferboard are "cheaper" than those built with plywood. When this point was discussed further with the builder/retailers, they stated that even though the waferboard is a technically sound product, and available to the consumer at a price saving over plywood, the consumer's "perception" is what counts. Many builders also felt that the several hundred dollars per house invested in the incremental cost of plywood, is a good insurance factor for the home. This feeling was prevalent in the more affluent areas of New England, the Cape Cod area, and southern Connecticut.

As noted earlier, many lumber yards contacted (in the North East) could not name contractors using waferboard for home construction. They did however say that some had been using waferboard, but due to narrowing pricing differentials and customer preference, have switched back to plywood. There appeared to be more people using waferboard for new home construction in The Mid Atlantic area (New York, Pennsylvania, and New Jersey).

Clearly, as housing start levels decline over the next two decades, panel consumption in this sector will decline, and waferboard must either gain a larger share of a shrinking market, or gain sales in other areas to keep growing. The American Plywood Association represents the interests of non veneer panel producers (waferboard and OSB) in the United States. In discussions with the American Plywood Association, they indicated that alternative markets are being pursued for waferboard, including the Do It Yourself market, non residential construction and the Export market. With plywood capacity (1986) at 25.8 billion sf, production at 22.0 billion sf, and shipments of 19.4 billion sf, the plywood industry is working at 85% capacity. Strong initiatives are being made by the plywood industry to maintain or increase its share of the housing sheathing market, and find new alternate markets for plywood. The United States waferboard industry worked at 85.9% capacity in the same year. The need is there to find alternative markets for panel products.

5.3 Panel Demand - Do it Yourself Market

The repairs and alteration market, or Do it Yourself trade, is the second largest component of demand for structural panel products. Estimates range from 28 to 36% of total panel demand, or 6.6 to 8.5 billion sf per year. According to Building Supply Home Center's Home Modernization study, home modernization spending reached a record high of \$80.9 billion in 1985, a 70% increase over 1981 levels. The trend is continuing, with 1986 spending projected at \$95.4 billion. It is estimated that materials represent approximately 50% of these costs, with the balance spent on contractor labour, profit, and overhead. Of the \$45 billion spent on materials, approximately half was "BIY", build it yourself spending, with materials purchased directly by the consumer for BIY projects.

At 70%, (Building Supply Home Centers, June 1987, Page 97), the level of BIY labour activity is high, while work done by professionals represents another 34.6% of projects. (The overlap of home builder working alongside the contractor accounts for the overlap). A recent survey completed by Building Supply Home Centers showed the 5 most common project types accounted for 8.5 million projects in the USA, with a value of \$20 billion.

Table 5-11

Five Most Common Major DIY Projects
USA 1985

Project	No. of Projects	Total Value
Exterior Room Addition	2.2 million	\$ 11.6 billion
Finished Basement Room	2.0 million	\$ 2.6 billion
Added Garage, Carport	1.3 million	\$ 2.8 billion
Enclosed porch, patio	2.3 million	\$ 2.6 billion
Expanded, Furnished Attic	714 thousand	\$379.4 million
Total	8.5 million	\$ 20.0 billion

The American Plywood Association projects structural panel demand for the Distribution Market (repair, remodelling, and miscellaneous uses) to expand from 1986 levels of 6.9 billion sf per year, to 7.95 billion sf per year in 1991.

Resource Information Systems Inc. projected the demand for United States Structural Panel demand for Repairs and Alterations to be 8.7 billion sf by 1988.

The United States Commerce Department noted that the Expenditure level of \$91.4 billion in 1986 represents at 13.8% gain over 1985 spending. Cahners Economics expects spending to grow another 12.6% in 1987 and 11.4% in 1988. 1988 spending levels in the United States are projected to be near \$115 billion. Although this year's projection data published by the APA show a modest 2.9% growth per year in this sector, they indicated that next year's projection report would be increasing this growth rate.

The strong levels of existing home sales is some indicator that spending levels in the repair and remodeling area will continue to be strong in the future.

Table 5-12

Sales of Existing Homes, USA
1986 - 1988

Year	Sales of Existing Homes
1986	3.6 million units
1987	3.4 million units
1988	3.3 million units

Table 5-13
Average Sales Price

New Houses Sold in the USA By Region

Year	USA (Average)	North East	Mid West	South	West
1982	\$ 83,900	\$ 88,600	\$ 87,700	\$78,300	\$ 92,600
1983	89,800	96,200	97,600	83,000	97,200
1984	97,600	107,400	107,800	86,000	109,400
1985	100,800	121,900	95,400	88,900	111,800
1986	111,800	150,800	102,800	94,700	116,800

Source: Construction Review

Other areas of the Do It Yourself Market include:

- cottages
- storage areas
- camps
- rough wall cladding
- boat sheds
- pool sheds
- enclosures

The Repair and Alteration market is clearly an area for good sales growth and potential over the next few years.

5.4 Panel Demand - Non Residential

5.4.1 Non Residential Building - United States

The value of non residential building construction in 1985 in the United States in 1985 represented approximately 30% of all construction put in place. (\$107 billion versus \$355 billion). A breakdown of the construction shows industrial construction at 13.2 billion.

Table 5-14			
Non Residential Buildings 1985 Construction Value, USA \$ Million			
	Private	Public	Total
Industrial	13,213		13,213
Office Buildings	29,017		29,017
Other Commercial	28,582		28,582
Hospital and Institutional	4,598	1,094	5,692
Educational		6,702	6,702
Other	15,359	8,891	24,250
Total	90,769	16,687	107,456

By comparison, the total value of all private residential construction in 1985 was \$133.88 billion, or 8% greater than non residential building construction. The value of non residential building construction in the United States has grown at 5.5% per year since 1980. (\$84.3 billion in 1980), and shows no sign of let up. Growth from 1985 - 1986 was 15.6%. The American Plywood Association shows approximately 1/3 of all structural panel demand in this sector.

Demand for structural panels in this sector is found in many areas:

- New construction
- Formwork
- Materials handling: Pallets
 Crates
 Shelving
- Transportation: Trucks
 Rail Cars
 Containers
 Wall Lining
- Maintenance & Repair

5.4.2 Non Residential Building - Canada

The value of non residential buildings constructed in Canada in 1987 is projected to be 40% of total building construction.

Table 5-15		
Value of Non Residential Building Construction Canada - 1986-1987		
	1986 (000)	1987 Est. (000)
Residential	\$28,636,294	\$29,280,676
Industrial	3,129,163	2,996,333
Commercial	9,865,118	10,743,741
Institutional	3,487,938	3,697,227
Other	1,883,086	1,971,978
	18,365,305	19,409,279
TOTAL	\$47,001,599	\$48,689,955

Source: Statistics Canada

5.5 Exports

Exports of softwood plywood from the United States decreased from 686 to 321 million sf (3/8" basis) from 1981 to 1985. Shipments soared to 595 million sf in 1986, and all indicators are that the industry could ship one billion sf of product in 1987.

Table 5-16				
Panel Products - Exports/Imports USA 1981-1986 (1 Million sf, 3/8" basis)				
Exports			Imports	
	Softwood Plywood	Particleboard Inc. Waferboard	Softwood Plywood	Particleboard Inc. Waferboard
1981	686	140	21	440
1982	452	82	21	445
1983	574	95	47	646
1984	371	108	73	955
1985	321	119	87	1068
1986	595	172	86	1032

Source: Construction Review, March/April 1987

The APA attributes increased exports of structural panel products to two factors; first, a declining dollar which helps makes United States products more competitive abroad, and second, the continued market development program which is educating more potential users on how to use United States structural panels. The acceptance of waferboard as a substitute for plywood will take time and effort. The demand for structural panel products is increasing in Europe even though the standard method of construction is based on masonry and concrete technology. To this end, Highland Forest Products in Scotland is in operation with full production going to the British Market.

Canadian exports of plywood have ranged from a high of 529 in 1980 to a low in 1986 of 310 million sf/year. This represents a drop from 19.5% to 14.7% of total production. Waferboard exports, mainly to the United States dropped from 1985's high of

836 million sf (55.6% of shipments) to 694 million sf (45.3% of production) in 1986. Exports are very important to Canada's panel industry.

Table 5-17		
Panel Products Exports Canada, 1977-1986 (Million sf, 3/8" basis)		
Year	Plywood	Waferboard
1977	465.6	N/A
1978	574.6	258.7
1979	528.5	304.3
1980	529.2	340.3
1981	420.5	336.5
1982	414.0	272.8
1983	469.3	425.8
1984	433.0	715.1
1985	412.6	836.4
1986	310.4	694.6

Source: Statistics Canada

SISKIN MANAGEMENT INC.
WAFERBOARD/OSB FACILITY
MARKETING FEASIBILITY STUDY, PHASE II
NORTH WESTERN NEW BRUNSWICK

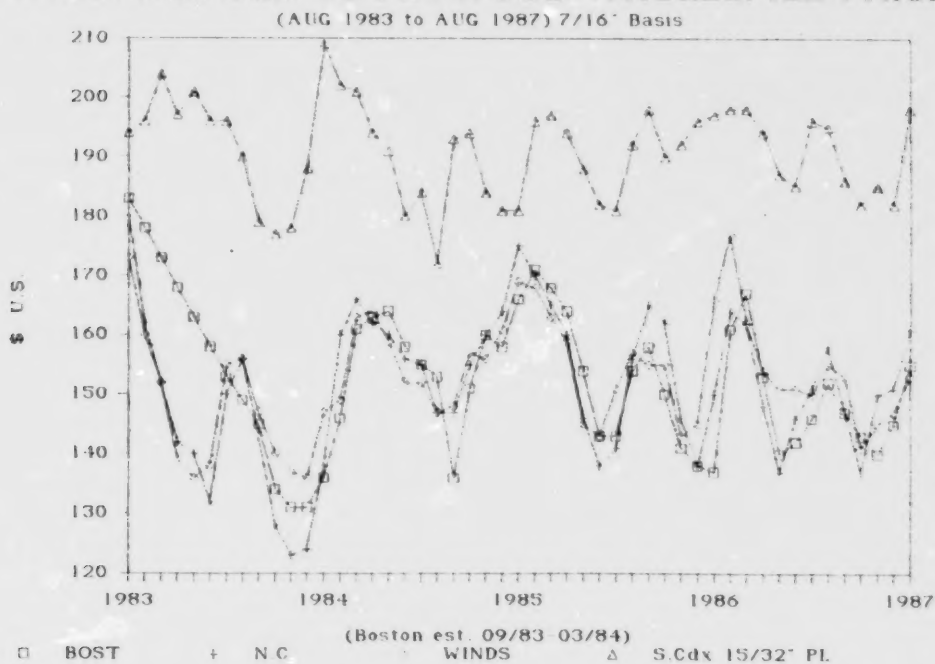
6 PRICING LEVELS

6.1 Pricing - Waferboard

Waferboard pricing levels in Boston have fluctuated from \$130 to \$183 US for 7/16" (Boston) during the period 1982 to 1987. The current wholesale level is \$155 (US). Figure 6-1 compares monthly wholesale prices for 7/16" waferboard at Boston, the North Central Region and Windsor from the period August 1983 to August 1987. All prices are US \$, North Central prices net f.o.b. mill; Windsor, prices delivered Windsor, duty paid; Boston, net f.o.b. mill, price to wholesaler. Comparative pricing is shown for 15/32" southern CDX plywood, delivered to the North East.

Figure 6-1

W.B.OARD/OSB vs PLYWOOD WHOLESALE PRICES



6.2 Transportation Costs & Mill Net Sales Price

The Canadian Mill net price (per msf., 3/8" basis) must be calculated using the wholesale price and deducting applicable duties and freight.

Freight rates from Northwestern New Brunswick to selected United State Markets for truck and rail are listed in Table 6-1.

Table 6-1

TRANSPORTATION COSTS, N.W.N.B. TO SELECTED U.S. DEST.

	RATE/LOAD		\$/LIFT		\$/MSF 7/16"		\$/MSF 3/8"	
	TRUCK	RAIL	TRUCK	RAIL	TRUCK	RAIL	TRUCK	RAIL
BANGOR ME	\$621	\$2,724	\$56.45	\$69.84	\$22.05	\$27.28	\$18.90	\$23.39
PORTLAND ME	\$916	\$2,182	\$83.27	\$55.96	\$32.53	\$21.86	\$27.88	\$18.74
BOSTON MA	\$1,067	\$2,716	\$97.00	\$69.63	\$37.89	\$27.20	\$32.48	\$23.31
NEW YORK NY	\$1,491	\$2,568	\$135.55	\$65.85	\$52.95	\$25.72	\$45.38	\$22.05
BUFFALO NY	\$1,943	\$3,148	\$176.64	\$80.71	\$69.00	\$31.53	\$59.14	\$27.02
PHIL. PA	\$1,451	\$2,780	\$131.91	\$71.28	\$51.53	\$27.84	\$44.17	\$23.87
CHICAGO ILL	\$2,586	\$3,677	\$235.09	\$94.28	\$91.83	\$36.83	\$78.71	\$31.57

Comparative pricing is also shown for truck and rail. The cost per lift of waferboard (80 sheets per lift) is calculated for each destination, with the equivalent price per thousand sf, on a 7/16" basis and a straight conversion to a 3/8" basis ($\times 6/7$). Based on these calculations, it is more economical to ship waferboard from Northwestern New Brunswick to the Boston market via rail than by truck. The cost is \$23.31 per msf 3/8". Sample calculations showing truck and rail rates, and mill net sales prices are shown in Table 6-2 and 6-3.

Table 6-2

A Comparison
Truck & Rail Rates
Compares msf, 3/8" basis

	Truck	Rail
Charge	\$1067.00	\$2716.00
# of lifts	11.00	39
Cost/lift	\$ 97.00	\$ 69.64
Msf/lift @ 7/16"	2.56	2.56
Cost/msf, 7/16"	\$ 37.89	\$ 27.20
Cost/msf, 3/8"	\$ 32.48	\$ 23.31

Notes: 1. Rail rate includes 19% currency surcharge (Rail surcharge).

2. Truck rate includes \$40 tarp charge.

Table 6-3

Sample Calculation
Mill Net Sales Price

	Truck	Rail
Sales Price Boston \$US, 7/16"	\$155.00	\$155.00
Converted to \$CDN (1.3285 Sept. 16, 1987)	205.91	205.91
Converted to 3/8" (6/7 factor)	176.50	176.50
Less Transportation	32.47	23.31
Net	144.03	153.19
Less Duty (4%)	5.76	6.12
Mill Net	\$138.27	147.07

6.3 Future Pricing Level - Waferboard/OSB

There are a number of factors that point toward a long term trend for waferboard prices to decrease. These include:

- over capacity in the plywood industry
- over capacity in the waferboard industry
- long term decline in the number of housing starts/year
- more severe competition from plywood to maintain existing levels of production in spite of declining housing starts
- overall trend line for waferboard pricing has been gradually decreasing over past 5 years.

In real terms as shown in Figure 6-1, the price of waferboard has decreased significantly over the past four years. Price increases should at least increase with inflation each year, and this has not happened.

The retail prices for 7/16" waferboard and 1/2" standard sheathing grade plywood are compared for US and Canada in Table 6-4.

Table 6-4		
Retail Pricing, Waferboard vs Plywood		
August 1987		
	Fredericton (\$ CAN/Sheet)	Boston (\$ US/Sheet)
7/16" waferboard	\$ 9.95	\$6.00
1/2" standard sheathing plywood	\$16.90	\$7.75 (CDX)

In the North Eastern United States, sheathing grade plywood is priced very competitively and many contractors have switched back to plywood from waferboard. In Canada, with a much larger price differential, contractors still use plywood, or in Atlantic Canada, lumber for wall and roof sheathing. This makes it more important for the waferboard industry to produce a lower priced, higher quality product to compete with and displace plywood. There are still many contractors who are slow to change or convince that waferboard is an acceptable alternative to plywood. The various waferboard associations have a great opportunity to influence buying decisions by doing more promotion and education with contractors, builders, and retailers.

SISKIN MANAGEMENT INC.
WAFERBOARD/OSB FACILITY
MARKETING FEASIBILITY STUDY, PHASE II
NORTH WESTERN NEW BRUNSWICK

7 INDUSTRY CONSUMER SURVEY

7.1 Introduction

As a part of this study, Siskin Management Inc. contacted wholesalers, retailers, producers, and users of waferboard/OSB in Canada and the United States. A list of companies and people contacted is found in Appendix 2.

Table 7-1

SURVEY SUMMARY

	PRODUCER WHOLESALE		RETAIL	OTHER	TOTAL	%
	-----		-----	-----	-----	----
CANADA						

NB	1	3	9	1	14	56.0%
NS		1	4		5	20.0%
PEI			3		3	12.0%
NFLD			3		3	12.0%
SUBTOTAL	1	4	19	1	25	100.0%
%	4.0%	16.0%	76.0%	4.0%	100.0%	
USA						

ME		1	1		2	8.0%
NH					0	0.0%
MA		3	6		9	36.0%
CT		1	2		3	12.0%
RI			1		1	4.0%
NY		2	3		5	20.0%
NJ			3		3	12.0%
PA			2		2	8.0%
SUBTOTAL	0	7	18	0	25	
%	0.0%	28.0%	72.0%	0.0%	100.0%	
TOTAL	1	11	37	1	50	
%	2.0%	22.0%	74.0%	2.0%	100.0%	

7.2 Methodology

The survey had 3 components:

- a) develop and test questionnaire with Fredericton based retailers;
- b) telephone survey - retailers and wholesalers, Canada and the United States;
- c) visit key wholesalers and retailers in the Boston area.

The questionnaire focused on the respondents' perception of current trends for shipments, and usage of waferboard (also compared to plywood shipments and usage). A copy of the full questionnaire is found in Appendix 3.

Key questions were:

- What is important to the buyer/consumer in terms of price/quality/end use?
- Are end users (builders/contractors, etc.) aware of the cost savings/benefits of using WB/OSB? (Compared to plywood.)
- Do you think that the market for waferboard/OSB is growing or shrinking in relationship to the market for plywood? Do you see any long term trends?
- What is the ratio of your softwood plywood to waferboard/OSB sales?
- How do you decide where to place an order for waferboard/OSB?
- Have contractors had problems with waferboard? Quality/Performance/Nail setting?
- Is there a shortage of waferboard in your area?
- Are you able to satisfy your customers' demands (for waferboard)?
- Is there room for another supplier of high quality waferboard/OSB?
- What advice would you give to a new manufacturer of waferboard/OSB?

7.3 Survey Results - Quantitative

The detailed questionnaire results are found in Appendix 4.
A summary of key findings is shown in the following table:

Table 7-2 Key Findings of Survey								
Canada					USA			All
Question		Retail	Whole-sale	ALL	Rtl.	Whsl.	All	All
WB/Total Panel	Inc.	50%	80%	56%	47%	25%	42%	50%
	N.C.	15%	-	12%	7%	25%	10%	11%
	Dec.	-	-	8%	7%	-	17%	9%
Shortage of WB	Yes	20%	20%	20%	13%	25%	16%	18%
	No	65%	80%	68%	73%	75%	73%	70%
Can You Supply?	Yes	75%	80%	76%	73%	100%	79%	77%
	No	5%	-	4%	6%	-	5%	4%
Is There room?	Yes	40%	20%	36%	46%	-	36%	36%
	No	40%	40%	40%	-	75%	16%	34%
	?	20%	40%	24%	40%	-	31%	23%

When asked if there was room for another manufacturer of quality OSB in the region (North Western New Brunswick), there was no consensus: 16 said yes, 15 said no, and 10 were not sure.

7.4 Key Findings of Survey

- 71% say that there is no shortage of waferboard in their area.
- 77% say that they can adequately serve their customers needs.
- 36% say that there is a need for another supplier of waferboard located in New Brunswick.
- 46% say that the market for waferboard is growing with respect to plywood.
- 73% say that the price is the key factor in their selection of a source of waferboard/OSB.
- 67% say that consumers consider mainly price when selecting waferboard over plywood.

- Few respondents could name large contractors using waferboard in new home construction. The usage of waferboard in new home construction appears to be more prevalent in the Mid Atlantic States (New York, Pennsylvania, New Jersey) than in the northern New England states.
- A number of respondents (United States) indicated that due to a) public opinion or perception, and b) a narrowing price differential between 7/16" waferboard and 1/2" CDX plywood, builders were switching from waferboard back to plywood for home sheathing. The retail price for 7/16" waferboard is \$6.00 per sheet, versus \$7.75/sheet for 1/2"CDX plywood. (Maine, Massachusetts, and Connecticut). By comparison, the Canadian retail price for 7/16" waferboard is \$9.95 per sheet, versus \$16.90 per sheet 1/2" standard spruce, 3 ply plywood.
- It appears that more of the region's waferboard demand is in the Do It Yourself area, rather than new home construction.
- 7/16" waferboard is by far the most widely sold product. Of 31 respondents who indicated the breakdown, 20 indicated that 7/16" represented 80% or more of their sales. The weighted average for all respondents was that 7/16" represented 75.2% of sales.
- Only 2 respondents indicated that there was some demand for 4 by 9 panels. Demand was not significant.
- Specific comments made by respondents during the survey are presented in Appendix 5.

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NORTH WESTERN NEW BRUNSWICK

8 SUPPLY AND DEMAND FOR WAFERBOARD/OSB

8.1 Projected Structural Panel Demand, North America

The American Plywood Association projects that United States Structural panel demand will increase at 2.61% per year over the next 5 years. The summary shows the historical growth rates for plywood, and waferboard, for the period 1977 to 1986.

Table 8-1 North American Plywood & Waferboard/OSB Industry Domestic Shipments Compound Growth Rate 1977-1986				
	Plywood	Waferboard/ OSB	Plywood & Waferboard	Waferboard/ Total
Canada	-1.7%	7.59%	0.04%	31.47%
USA	+0.4%	41.83%	2.63%	17.90%
Combined	-0.2%	31.04%	2.38%	19.28%

Estimates of future shipments have been made based on the historical industry growth rate (1977-1986) of 2.38% per year. US plywood consumption has increased at 0.4% per year, Canadian plywood consumption has decreased at 1.7% per year, and Canadian waferboard has increased at 7.57% per year. Shipments of US waferboard make up the difference.

Table 8-2
NORTH AMERICA
WAFERBOARD, PROJECTED CONSUMPTION BY REGION
(million sf, 3/8" basis)
1986-1991

	WEST	ONT/NC	SOUTH	EAST	TOTAL
1986	599	1767	1357	1354	5077
1987	664	1961	1522	1510	5657
1988	730	2161	1690	1669	6251
1989	799	2367	1862	1832	6860
1990	870	2578	2036	1999	7483
1991	943	2796	2213	2169	8122
1986	11.8%	34.8%	26.7%	26.7%	
1987	11.7%	34.7%	26.9%	26.7%	
1988	11.7%	34.6%	27.0%	26.7%	
1989	11.7%	34.5%	27.1%	26.7%	
1990	11.6%	34.5%	27.2%	26.7%	
1991	11.6%	34.4%	27.3%	26.7%	

Regional shipments are estimated based upon a review of estimates by APA and RIS.

Table 8-3
Panel Demand By Region, USA 1988
Comparison of Estimates

Region	APA Estimate Plywood	RIS Plywood	RIS Waferboard
N.E.	20.40%	15.0%	26.76%
N.C.	12.58%	17.0%	30.98%
South	37.46%	37.5%	31.92%
West	26.03%	30.5%	10.33%

Based upon these figures and historical shipment data from Statistics Canada, the following regional shipments are estimated for each region.

For the purpose of analysis, North America has been divided into four major areas:

- West US West
 B.C., Prairies
- Ont./NC Ontario, US North Central
- South US South
- East US North East, Quebec
 Atlantic Provinces

Waferboard consumption by region is estimated for the period 1986 to 1991 in Table 8-4. Detailed calculations are found in Appendix 6.

Table 8-4

PROJECTIONS, DOMESTIC CONSUMPTION
USA & CANADA, 1987-1991
(million sf, 3/8" basis)

YEAR	USA		CANADA		TOTAL		TOTAL	W.B.
	PLYWOOD	W.B.	PLYWOOD	W.B.	PLYWOOD	W.B.		
1986	19436	4240	1823	837	21259	5077	26336	19.3%
1987	19514	4757	1792	900	21306	5657	26963	21.0%
1988	19592	5283	1762	969	21353	6251	27605	22.6%
1989	19670	5818	1732	1042	21402	6860	28261	24.3%
1990	19749	6362	1702	1121	21451	7483	28934	25.9%
1991	19828	6916	1673	1206	21501	8122	29623	27.4%

8.2 Projected Supply/Demand

Based on the number of plants under construction, and those announced, Waferboard/OSB capacity is projected to be approximately 8 billion sf/year in 1988. Waferboard/OSB demand is projected to be 6.3 bsf in 1988, and 8.1 by 1991.

Table 8-5

North American Supply/Demand
Waferboard/OSB
1988-1991
(Million sf, 3/8" basis)

	West	Mid	South	East	Total
1988 Capacity	1830	2765	1955	1456	8006
1988 Demand	730	2161	1690	1669	6250
1991 Demand	943	2796	2213	2169	8121

Figure 8-1

WAFERBOARD/OSB; SUPPLY/DEMAND NORTH AMERICA, BY REGION, 1988

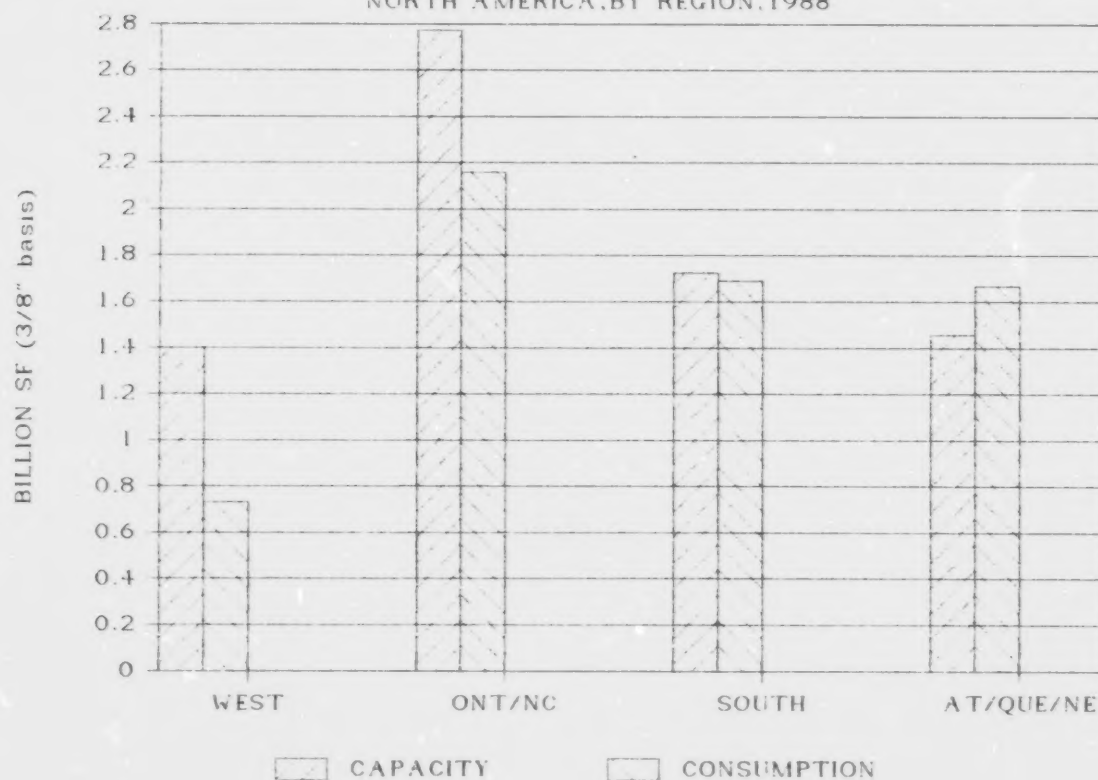
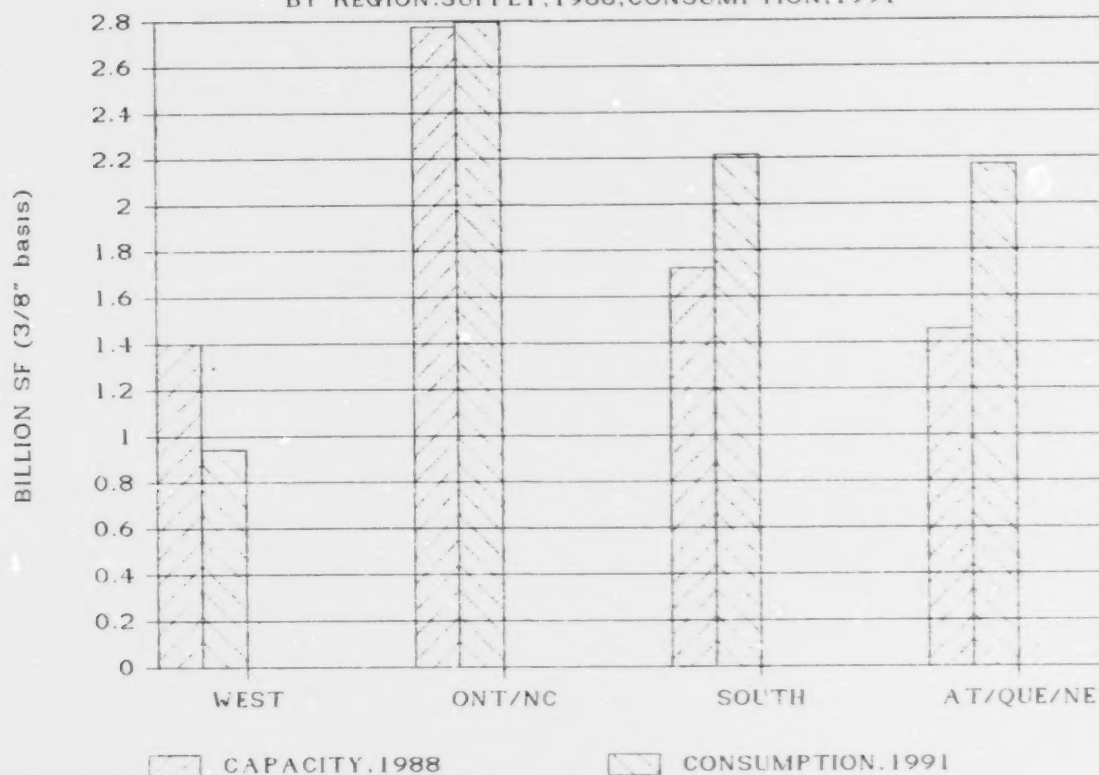


Figure 8-2

N. A.- WB/OSB; SUPPLY/DEMAND

BY REGION: SUPPLY, 1988; CONSUMPTION, 1991

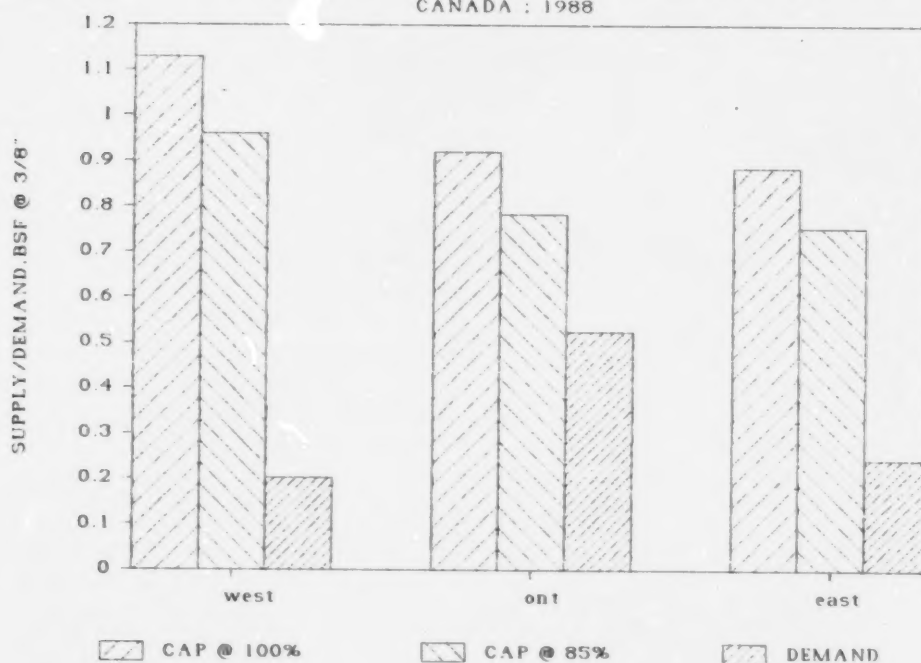
8.3 Canada

In 1986, all regions of Canada had excess production capacity over and above regional demand requirements. By 1988, it is predicted that the Canadian Waferboard Industry will have approximately 2.8 times more production capacity than the domestic market will require. The supply and demand requirements for each of the four regions is shown in Table 8-6. (1986 and 1988)

Table 8-6
Canada - Supply/Demand
Waferboard/OSB

1986	West	Ont.	Que.	Atl.	Total	Export
Demand	175	453	155	54	837	-
Supply	870	620	440	-	1930	-
Available for Export	695	167	285	54	1093	695
1988						
Demand	202	524	180	63	969	-
Supply	1130	920	700	186	2936	-
Available for Export	928	396	520	123	1967	-

Figure 8-3
WB/OSB; SUPPLY / DEMAND
CANADA : 1988



With this tremendous over capacity, Canadian plants have been in a good position to supply the growing United States market, particularly in the North Central and North East regions. Historical exports to the United States are shown in Table 8.7.

Table 8-7			
Canada - Waferboard Exports (Million sf, 3/8" Basis) 1978-1986			
Year	Shipments	Exports	% Export
1978	516.1	258.7	50.1%
1979	597.2	304.3	50.9%
1980	651.5	340.3	52.2%
1981	751.5	336.5	44.8%
1982	605.7	272.8	45.1%
1983	961.8	425.8	44.3%
1984	1346.5	715.1	53.1%
1985	1504.1	836.4	55.6%
1986	1531.9	694.6	45.4%

During the past 8 years, exports to the United States have represented on the average, 49% of Canada's production capacity.

Canadian supply as a percent of USA consumption has decreased to 16.3% of the total. This figure will probably continue to decline as new United States plants are established.

In its June 1987 economics report on the Regional Production and Distribution Patterns of the Structural Panel Industry, the American Plywood Association predicted that "expansion of sales (Canadian) in the United States market will be limited due to the increasingly competitive United States industry and its ability to fill local demand."

8.4 United States

Having identified the Waferboard/OSB supply/demand situation for Canada and estimating potential export quantities, it is then necessary to look at the United States situation to evaluate opportunities for future exports of Canadian waferboard/OSB.

The supply/demand estimate for 1986 and 1988 for each of the four regions of the United States is shown in Table 8-8.

Table 8-8
United States
Waferboard/OSB Supply/Demand By Region
1986

1986	West	South	N/C	N.E.	Total
Demand	440	940	1220	1190	3790
Supply	270	1590	1585	570	4015
Net	-170	650	365	-620	225
1988					
Demand	528	1638	1690	1426	5282
Supply	700	1955	1845	570	5070
Net	+172	+317	155	-856	-212

In 1986, the West and North East had greater demand than regional supply. It appears that in looking at the overall North American situation, there will be a surplus of capacity over projected demand by 1.75 billion sf in 1988. There is a net deficit of 212 million sf/year in the United States with a 1967 million sf/year surplus in Canada. 1986 levels of exports from Canada are 694.6 mmsf/year.

8.5 Comparison - Waferboard Supply/Demand to Housing Starts and Population

Data is consolidated in this table to show the comparison between projected waferboard supply and demand, versus housing starts and population.

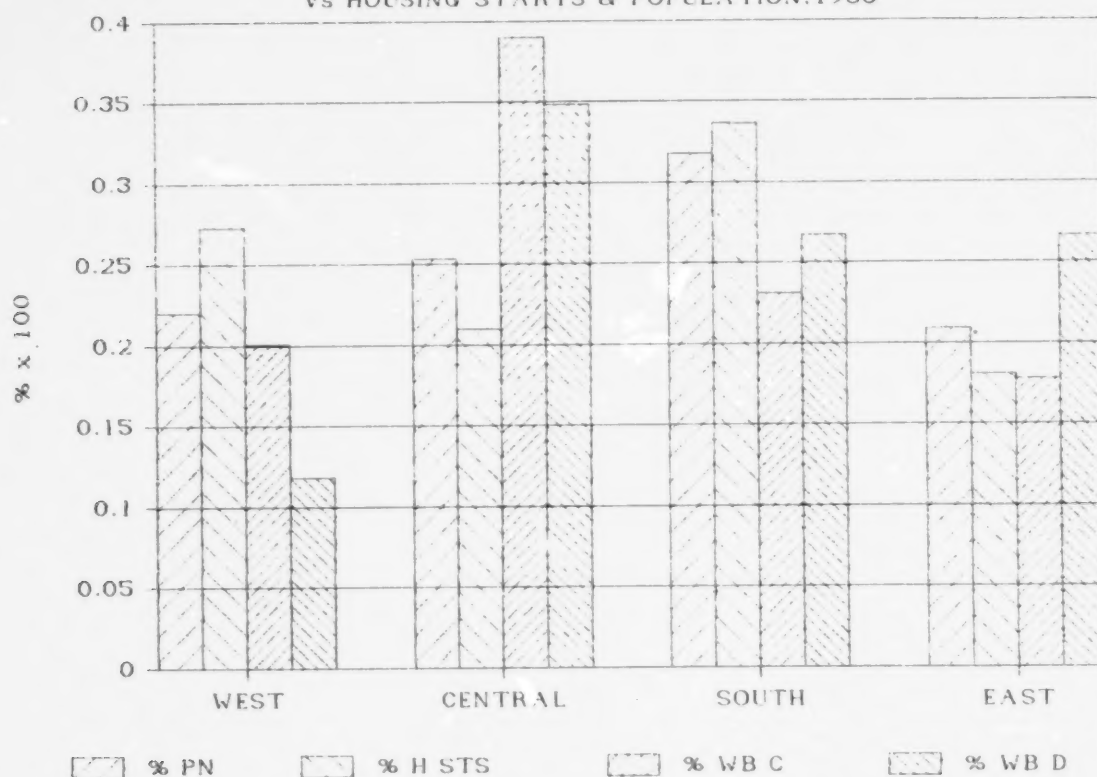
Table 8-9

North America
Comparison, Population & Housing Starts
vs Waferboard/OSB Production Capacity & Demand

	West	Ont/N.C.	South	Atl./Que./N.E.
Population	22.0%	25.3%	31.8%	20.9%
Housing Starts	27.3%	21.0%	33.6%	18.1%
WB PDN Capacity	22.9%	34.5%	24.4%	18.2%
WB Demand	11.7%	34.6%	27.0%	26.7%

Figure 8-4

NORTH AMERICA-WAFERBOARD SUPPLY/DEMAND
vs HOUSING STARTS & POPULATION, 1986



8.6 Summary

- Overall panel demand is growing at 2.4% per year.
- 1986 Canadian shipment at 80% of total capacity (1532 vs 1930 million sf/year); by 1988 predicted to be at 60% (1769 vs 2936).
- 1986 US shipments at 85% of total capacity (3545 vs 4126 million sf/year); by 1988 predicted to be at 88% (4482 vs 5070 million sf/year).
- In 1988 the west (US & Canada), Mid (Ontario and North Central) and South regions of North America will be net exporters of waferboard. Overall capacity (8006) is 1.75 billion sf greater than projected demand.
- By 1991, demand catches up to production capacity. The Eastern region (US North East) is the major importer.
- There will be room for several waferboard/OSB plants (estimated potential, 700 million sf/year) to be built in the North Eastern Region in the period 1988 to 1991.

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NORTH WESTERN NEW BRUNSWICK

9 MARKETING SUPPORT

9.1 How Waferboard/OSB is Purchased

Waferboard/OSB is a generic product sold in the marketplace through wholesalers and retailers. The product is generally thought to have equal properties and characteristics irregardless of which mill it comes from. Each of the fifty respondents in our survey were asked how they decided to purchase waferboard. Respondents were also asked why the end user decides to purchase waferboard rather than plywood.

The majority of respondents indicated that price was the single most important factor in their decision as to where they purchased waferboard/OSB. The majority also indicated that the consumer usually purchases waferboard because of one key factor: price.

Table 9-1		
Summary of Responses How Waferboard Is Purchased		
Number of Responses		
	Retailer/Wholesaler	End User
Price	31	32
Specs/Quality	5	4
Delivery	3	2
Brand/Existing Supply	6	2
Availability	3	-

A number of respondents indicated that they would sometimes exclude certain manufacturers' products when ordering. End users also had some preferences; however, the strong tendency is to shop in the open market and buy on price. Quality and service are assumed equal for all products.

9.2 Sales and Sales Support

To be successful in the marketplace, a supplier must supply a top quality board both in appearance and performance. The product must be competitively priced.

Several larger retailers in the United States said that even though there is lots of product in the marketplace, there is room for a new company to do well, through aggressive sales and marketing. Many manufacturers are just order takers, and do not actively push this product. Wholesalers indicated that most mills have a person who is responsible for sales. This person usually sells from the mill, and does not usually visit the end users to push the product. Again, wholesalers felt mills could increase sales with more aggressive, personal selling.

9.3 Promotional Literature

Promotional literature should do several things to help the company "sell" its product. The literature should provide information about the product; specifications, uses, etc. Respondents in the United States were particularly concerned about span ratings. Report NER-108 describing the specifications for APA Structural Use Panels is found in Appendix 7. In this market, it would be beneficial to try and differentiate the product, and show the benefits of using this product, rather than plywood, or another type of waferboard. With a new company, the literature must make the announcement that "we are in the market place," and help to build that credibility. The promotional literature must establish a presence and an awareness of the company and the product. Through all promotional activities, the company will endeavor to build a reputation which must, in the end, be upheld through performance and reliability. Copies of sample literature are found in Appendix 8.

9.4 OSB

Twenty-two of 32 respondents indicated they did not pay a premium for OSB. Wholesalers either buy only OSB, or buy waferboard with an acceptable span rating for the end use. Retailers who serve the DIY market, have in the past carried both OSB and waferboard. The end user did not appreciate the difference in the two products. With the narrowing price differential, many only carry one product (usually named waferboard).

SISKIN MANAGEMENT INC.

WAFERBOARD/OSB FACILITYMARKETING FEASIBILITY STUDY, PHASE IINORTH WESTERN NEW BRUNSWICK10 CONCLUSION

By 1988, Canadian domestic production capacity will be approximately three times bigger than the available domestic demand. Assuming that a new Canadian waferboard/ OSB mill can acquire its fair share of the domestic market, the mill must export at least 50% of its product to remain in business.

With existing plants under construction (or announced) there will be adequate US and Canadian capacity to satisfy domestic demand through 1988. By 1989-90, there is predicted to be (based upon historical industry growth rates) sufficient demand to warrant construction of several additional plants (700 million sf/year) to serve the US North East Region. It would appear that there will be sufficient future market demand to support this proposed facility.

For a New Brunswick waferboard/OSB mill to be successful in the marketplace, it will be necessary to:

- Be a high volume, low cost producer.
- Produce a top quality product. It does not seem likely that a new mill can enter the market with either a shop grade product or a specialty product. The key to success is to produce a competitively priced, top quality, standard board for new home construction and DIY markets.
- Set pricing levels which are very competitive
- Be very aggressive in the marketplace; target large wholesalers/retailers in Eastern North America; maintain a pro active rather than a reactive sales effort.
- Target end use markets in non new housing areas, e.g., DIY (Do it Yourself) and non residential construction uses. The DIY market is growing and is a big end user of panel products.
- Gain an industry reputation for service, quality, dependability, and value.

The viability of this proposed new plant is dependent upon three key factors:

- the available margin between the mill net price (existing range, \$145 (CDN) to \$155/msf, 3/8" basis) and its manufacturing costs
- available wood resource
- end market

The available margin between the mill net sales price and the cost of production will be determined by several factors. The market price (present US wholesale price ranges from \$145-155 US), transportation costs, and tariffs affect the mill net sales price.

Production rates (per msf produced) can vary considerable between various sized mills. Larger mills are often most competitive because fixed operating costs (including capital cost allocation and layout) are lower per unit of production.

The industry has seen many large waferboard/OSB mills locate in the US North Central regions, and the South Atlantic states for two main reasons; an abundant wood supply and proximity to end use markets. A new mill in New Brunswick must have some advantage in the marketplace in order to succeed. Assuming that this mill will pay more or less the same for wood supply as other local mills (Maine & New Brunswick), and that transportation costs to US markets are competitive (as noted by CN Rail - rates quoted are competitive with New Brunswick and Northern Quebec mills), this mill must be able to maintain its profit margin through plant sizing and through an aggressive marketing program.

APPENDIX 1

HOUSING ECONOMICS:

THE OUTLOOK FOR HOUSING FORMATIONS

The Outlook for Household Formations

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E3B 2T7

Michael S. Carliner

The demand for housing is critically dependent on the number and type of household formations. Since a household is defined as a person or group of people who occupy a housing unit, the demand for primary housing units is necessarily equal to the number of households. The future increase in the number of households is the subject of two recent major studies—one by the Census Bureau¹ and one by the John Pitkin and George Masnick of the Harvard-MIT Joint Center for Housing Studies, under sponsorship from HUD.² Both analyses provide projections that indicate a slowdown in the rate of household forma-

net increase in households and will rise from 28 percent of total households in 1985 to account for about 31 percent in 1995.

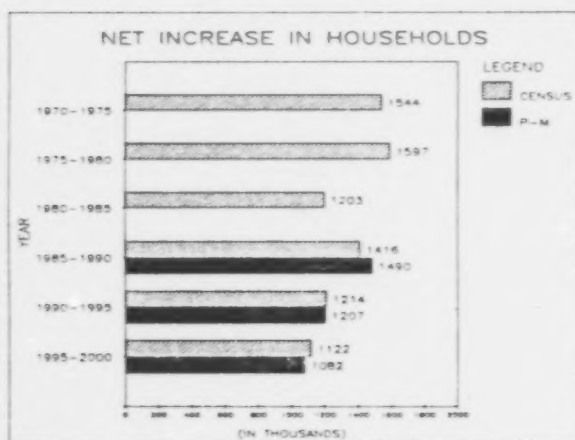
Mainly because of changes in the age structure of the population, but also as a result of changes in marital status and household-forming propensities, the biggest increases in numbers of households will consist of increases in households headed by people 35 to 54 years of age

The Factors Behind Household Formations

The number of households in the future depends on one highly-predictable factor—the future population in each age group—plus a number of less-predictable behavioral factors.

The adult population in each age group is predictable because it depends on past birth patterns, which are known, and on death rates, which change slowly. It also depends on international net immigration, which is not fully predictable, but which is controlled to some extent.

Figure 1



tions between now and the end of the century. However, as Figure 1 shows, the average over the next decade is expected to be higher than the severely-depressed rates of household growth experienced in the first half of the 1980's.

Although the increase in the number of married couple households over the next decade will be greater than the increase over the last decade, the increase in married couple households is projected to comprise less than a third of the total increase in households, with the result that the share of total households that are married couple households will continue to fall from the 58 percent share recorded in 1985 to about 54 percent.

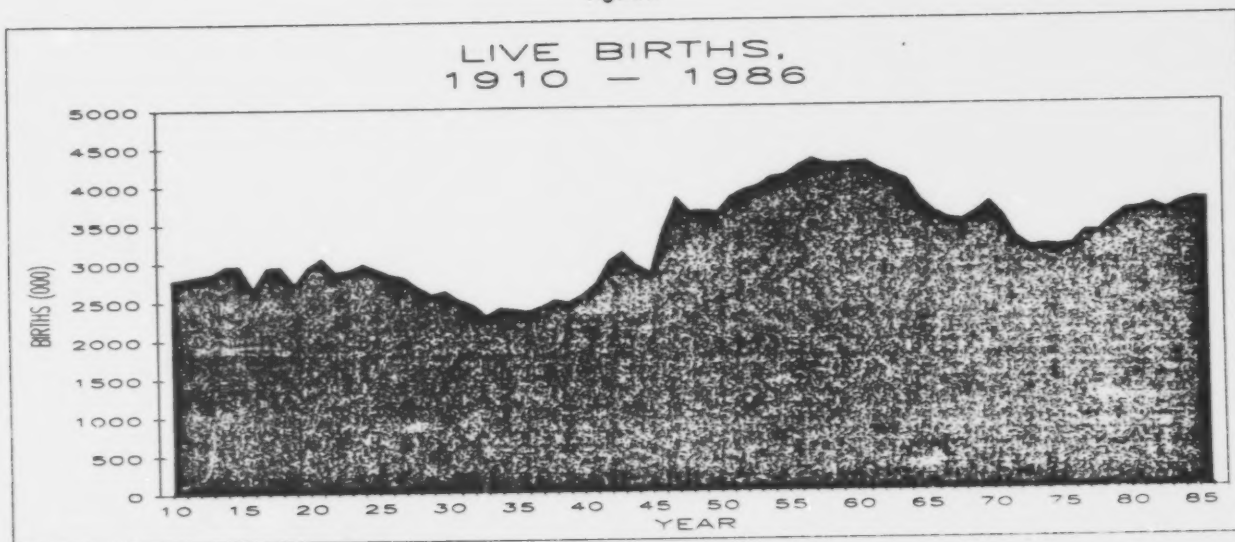
In 1995, other family households (mainly single parents) are projected to account for a slightly larger share—rising from 14 percent of the total in 1985 to 15 percent in 1995. The greatest increase, however, will be among nonfamily households, the overwhelming majority of which are people living alone. Non-family households will account for about half of the

Table 1

POPULATION (INCLUDING ARMED FORCES OVERSEAS) (IN THOUSANDS)					
	1975**	1980***	1985*	1990*	1995*
ALL TYPES:					
18-24	28,006	30,350	28,739	25,794	23,702
25-29	17,280	19,804	21,838	21,522	18,822
30-34	14,191	17,822	19,950	22,007	21,698
35-44	22,831	25,868	32,004	37,847	41,997
45-54	23,756	22,754	22,464	25,402	31,397
55-64	20,045	21,761	22,188	21,051	20,923
65-74	13,915	15,653	16,855	18,035	18,503
75 +	8,779	10,052	11,754	13,662	15,385
TOTAL:	148,803	164,064	175,792	185,320	192,427
*1985, 1990, 1995, SERIES P-25, NO. 952.					
**1975, SERIES P-25, NO. 917.					
***1980, SERIES P-25, NO. 1000.					

Figure 2 shows the record of births since 1909. The increases in births in the 1940's and 1950's mean large increases over the next decade in the population in the 35 to 54 year-old age group. Lower births in the 1920's and 1930's and in the 1960's and 1970's mean declines in the adult population aged under 35 and aged 55 to 64. Table 1 shows the past and projected population by age.

Figure 2



The less certain element in household projections is the number of people in each age group who will become household heads. Moreover, the types of households they will form (married couple, unmarried couple, roommates, living alone, etc.) are also uncertain. However, while those choices are not certain, they are not random, but reflect tradition, the biological realities of age, economics, the supply of housing, and the long-term effects of choices made in the past.

The propensity of the population in a particular group to form separate households is measured by a statistic called the headship rate--the percentage of people in the group who are heads of households.

Recent Experience

In the 1970's, there were large increases in the number of households, as the effects of the baby boom reaching adulthood were augmented by changes in behavior. Postponement of marriage, and rising divorce rates among those who did marry, resulted in large increases in the number of people living alone or in various combinations other than as traditional married couples.

In the early 1980s, behavioral shifts on the part of young adults worked to reduce the number of households. The headship rate declined for age groups under 35 years old, as the divorce rate fell and the proportion of young adults who lived with their parents increased sharply.

The retrenchment in household-forming behavior in the first half of the 1980's was restricted to the younger age brackets. Among people over age 35, headship rates continued to increase somewhat.

The New Projections

The Pitkin-Masnick and Census projections both start from Census Bureau projections of population by age and sex, and first project the marital status of those age and sex groups. The proportions of each age-sex-marital status group that become heads of households are then projected, based mainly on past trends in the propensity of each group to form households. The historical trend period used and other aspects of the methodology differ somewhat between the two studies. Those methodological differences are described below in an appendix. The resulting projections of households by age and type are shown in Table 2.

While the Pitkin-Masnick and Census studies differ only slightly on the overall increase in the number of households, Pitkin and Masnick project a larger increase in households with heads over age 45. Moreover, Pitkin and Masnick project a larger share of nonfamily households and a smaller share of married couples. However, while the two projections differ on the magnitudes, they agree that the largest proportionate growth will come from middle-aged non-traditional households and that married couples under age 30 are practically an endangered species.

An examination of the headship rates by age shown in Table 3 indicates the extent to which the projected changes in the number of households are based on assumed changes in behavior rather than changes in population by age (although changes in the relative number of males and females in each age bracket and the age distribution within bracket are reflected in these headship rates, as well as behavioral changes).

Table 2

HOUSEHOLD PROJECTIONS 1985, 1990 AND 1995 P-M VS. CENSUS						
	1985		1990		1995	
	CENSUS	P-M	CENSUS	P-M	CENSUS	P-M
ALL TYPES:						
18-24	5,307	4,420	4,627	3,961	4,270	
25-29	9,807	9,436	9,663	8,018	8,427	
30-34	10,332	11,556	11,520	11,388	11,500	
35-44	17,733	21,201	21,245	23,584	23,916	
45-54	12,629	14,407	14,429	18,155	18,035	
55-64	12,980	12,617	12,311	12,649	12,233	
65-74	10,864	11,928	11,672	12,450	12,006	
75 +	7,461	8,999	8,724	10,393	9,876	
TOTAL	87,113	94,564	94,191	100,598	100,262	
MARRIED COUPLES:						
18-24	2,061	1,528	1,553	1,254	1,228	
25-29	5,375	4,448	4,888	3,437	3,885	
30-34	6,315	7,010	6,603	6,539	6,136	
35-44	11,782	13,385	13,610	14,609	14,721	
45-54	8,569	9,465	9,551	11,372	11,631	
55-64	8,282	7,791	7,828	7,652	7,760	
65-74	5,623	5,944	6,021	6,020	6,170	
75 +	2,539	2,869	2,953	3,193	3,328	
TOTAL	50,546	52,440	53,008	54,076	54,859	
OTHER FAMILIES:						
18-24	959	851	919	791	919	
25-29	1,452	1,501	1,522	1,353	1,416	
30-34	1,701	1,726	1,977	1,792	2,050	
35-44	3,097	3,762	3,758	4,088	4,273	
45-54	1,979	2,286	2,338	2,882	3,015	
55-64	1,444	1,553	1,354	1,517	1,326	
65-74	964	1,161	987	1,207	969	
75 +	795	929	876	1,038	934	
TOTAL	12,392	13,769	13,731	14,568	14,902	
NON-FAMILY:						
18-24	2,287	2,041	2,155	1,916	2,122	
25-29	2,980	3,487	3,253	3,228	3,125	
30-34	2,317	2,820	2,941	3,057	3,315	
35-44	2,854	4,054	3,877	4,887	4,922	
45-54	2,081	2,656	2,540	3,901	3,389	
55-64	3,254	3,273	3,129	3,480	3,148	
65-74	4,276	4,823	4,664	5,223	4,867	
75 +	4,126	5,201	4,894	6,162	5,614	
TOTAL	24,175	28,355	27,453	31,854	30,501	

Table 3

HEADSHIP RATES					
	1985	1990		1995	
	CENSUS	P-M	CENSUS	P-M	CENSUS
ALL TYPES:					
18-24	18.5%	17.1%	17.9%	16.7%	18.0%
25-29	44.9%	43.8%	44.9%	42.6%	44.8%
30-34	51.8%	52.5%	52.3%	52.5%	53.0%
35-44	55.4%	56.0%	56.1%	56.2%	56.9%
45-54	56.2%	56.7%	56.8%	57.8%	57.4%
55-64	58.5%	59.9%	58.5%	60.5%	58.5%
65-74	64.5%	66.1%	64.7%	67.3%	64.9%
75 +	63.5%	65.9%	63.9%	67.6%	64.2%
TOTAL	49.6%	51.0%	50.8%	52.3%	52.1%
MARRIED COUPLES:					
18-24	7.2%	5.9%	6.0%	5.3%	5.2%
25-29	24.6%	20.7%	22.7%	18.3%	20.6%
30-34	31.7%	31.9%	30.0%	30.1%	28.3%
35-44	36.8%	35.4%	36.0%	34.8%	35.1%
45-54	38.1%	37.3%	37.6%	36.2%	37.0%
55-64	37.3%	37.0%	37.2%	36.6%	37.1%
65-74	33.4%	33.0%	33.4%	32.5%	33.3%
75 +	21.6%	21.0%	21.6%	20.8%	21.6%
TOTAL	28.8%	28.3%	28.6%	28.1%	28.5%
OTHER FAMILIES:					
18-24	3.3%	3.3%	3.6%	3.3%	3.9%
25-29	6.6%	7.0%	7.1%	7.2%	7.5%
30-34	8.5%	7.8%	9.0%	8.3%	9.4%
35-44	9.7%	9.9%	9.9%	9.7%	10.2%
45-54	8.8%	9.0%	9.2%	9.2%	9.6%
55-64	6.5%	7.4%	6.4%	7.3%	6.3%
65-74	5.7%	6.4%	5.5%	6.5%	5.2%
75 +	6.8%	6.8%	6.4%	6.7%	6.1%
TOTAL	7.0%	7.4%	7.4%	7.6%	7.7%
NON-FAMILY:					
18-24	8.0%	7.9%	8.4%	8.1%	9.0%
25-29	13.6%	16.2%	15.1%	17.2%	16.6%
30-34	11.6%	12.8%	13.4%	14.1%	15.3%
35-44	8.9%	10.7%	10.2%	11.6%	11.7%
45-54	9.3%	10.5%	10.0%	12.4%	10.8%
55-64	14.7%	15.5%	14.9%	16.6%	15.0%
65-74	25.4%	26.7%	25.9%	28.2%	26.3%
75 +	35.1%	38.1%	35.8%	40.1%	36.5%
TOTAL	13.8%	15.3%	14.8%	16.6%	15.9%

For the 18 to 24 year-old group, the decline in the population is exacerbated by a projected decline in headship. In 1985, 18.5 percent of the people in that age bracket were household heads. For 1995, Pitkin, and Masnick project that only 16.7 percent will be household heads, while Census projects a headship rate of 18.0 percent. Combined with a 17.5 percent decline in population in that age group between 1985 and 1995, the results are declines of 25.3 percent and 19.5 percent, respectively, in the Pitkin-Masnick and Census household projections.

Among the population groups over age 30, both studies generally project increases in overall headship rates by age, so that the percentage increase in households exceeds the percentage increase in population.

In both sets of projections, for nearly all age groups and years, the percentage of people expected to head married couple households is lower in the future than in 1985. Thus, the projected increase in the number of married couple households is due entirely to the increase in the adult population and to the changing age structure, not to any greater popularity of marriage.

Alternatives

In addition to presenting a projection that they consider most likely, the authors of each study also present alternative forecasts based on other assumptions. The Census report gives a range of 1.14 to 1.60 million for the average annual increase in households from 1985 to 1995, with the lower figure based on an assumption that the increase will be due

solely to changes in population by age, with no increase in the propensity to form households.

The Pitkin-Masnick report uses a variety of assumptions about income growth to produce a range of 1.22 million to 1.45 million average annual increase in households between 1985 and 1995. They also show a range of projections based on different assumptions about marriage rates, but don't show the combined effects of income and marriage changes.

The Bottom Line

Some of the implications for the housing industry of the forthcoming changes in the number and distribution of households by age and type are obvious, while other implications are not. In any case, that will be the subject of an article in next month's *Housing Economics*.

Appendix: Methodology

The details of the methodology used in each of the two sets of projections are fairly complex, and the interested reader should refer to the original reports. In this appendix we only attempt to highlight a few distinctions between the two studies. The principal differences include the use of the 1959 to 1985 historical periods in the Census projection compared to only 1975 and 1980 data by Pitkin and Masnick, and the use of cohort data by Pitkin and Masnick compared age-bracket data by Census.

In the Census analysis, the headship rate in each age-sex-marital status group is projected to fall between the actual 1985 rate and the rate indicated by the trend in headship rates for that group over the 1959 to 1985 period. In other words, it is assumed that the trend will continue in the same direction, but the future changes will be smaller than the past changes.

While the methods used by Census to calculate the trends are statistically sophisticated, the Census methodology is deliberately naive in terms of incorporating other information besides the past history of the family and household proportions within each age bracket. Similarly, the choice to project future proportions based on one-half of the calculated slope of the past trend is an arbitrary procedure. This is not to say that the projections are not useful, or that the choice among naive models was not influenced by awareness of the economic, social, and other factors affecting household formations.

The Pitkin-Masnick projections base the headship rate for each group not only on past behavior of people in that age bracket, but also on the behavior of each cohort (the people born during a particular

time period) when they were younger. Thus, if the cohort consisting of everyone born in the 1950 to 1954 period had an unusually large share of its members living alone when they were 30 to 34 years old, it is projected that at age 35 to 39 they will also have an unusually large share living alone. The family and household distribution of a cohort as it enters an age bracket is projected to change from its distribution in the preceding age bracket as previous cohorts changed while in that age bracket. Specifically, the changes exhibited in each age bracket over

the 1975 to 1980 period are used by Pitkin and Masnick to project the changes in the 1985 to 1990, 1990 to 1995, and 1995 to 2000 periods.

The Pitkin-Masnick approach assumes that behavior displayed by a cohort will stay with them. That means that the younger cohorts who had low headship rates in the early 1980's will not bounce back, but will continue to behave in a relatively similar fashion. On the other hand, the cohorts that were in their 30s in 1980 and who had unusually high headship rates at that age will continue to have headship rates throughout their lifetimes that are higher than the cohorts that preceded them.

The Pitkin-Masnick study has a number of other interesting features. Estimates of the sensitivity of household formations to income are presented and are used to produce alternative forecasts. Alternative assumptions about marriage rates are also shown. In addition to producing projections of the three types of households shown here, a more detailed breakdown into six types is presented. Finally, Pitkin and Masnick make projections of housing demand by tenure and number of rooms, using a methodology similar to that used in projecting households.

The Census people have also been busy. In addition to the projections described here, they also present some preliminary results from a project to develop econometric models of household formations.

Notes

¹ U.S. Bureau of the Census, *Current Population Reports, Series P-25, No. 986, Projections of the Number of Households and Families: 1986 to 2000*

² John R. Pitkin and George S. Masnick, *Households and Housing Consumption in the United States, 1985 to 2000: Projections by a Cohort Method*, (Joint Center for Housing Studies, Cambridge, MA, Research Report RJ86-1, 1986)

APPENDIX 2

LIST OF PERSONS/COMPANIES CONTACTED

COMPANIES/PERSONS CONTACTED
UNITED STATES
(* Visited)

- 1 Agway Inc.
George McCordick
DeWitt, NY
315-477-7061
- 2 Ajayen Lumber
Bill Fry
Walden, NY
914-778-3501
- 3 American Plywood Association
Bob Anderson
Dave Rogaway
Tacoma, Washington
206-565-6600
- 4 Atlantic Plywood Corporation
Paul Vella
Woburn, Mass.
617-933-3830
- 5 Babcock Lumber Company
Dennis Wiel
Lancaster, NY
716-683-8888
- 6 Brewster's
Mike Brennan
Hartford, Ct.
203-549-4800
- 7 Brewster's
Ray Willis
Millford, Ct.
203-877-1441
- 8 Brewster's
Frank Azino
Providence, RI
401-781-9100
- 9 Busy Beaver Building Center
Mike Coleman
Pittsburgh, PA
412-963-1980
- 10 Busy Beaver Building Center
Robert Fagen
Verona, PA
412-793-7300

- 11 Channel Home Centers
Willian Fredericks
Burt Sifton
Whippany, NJ
210-887-7000
- 12 Fafard Construction
Jim David
Ashland, Mass.
617-881-1600
- 13 Fagen's Inc. Building Centers
Joseph Wisniewski
Verona, PA
412-793-7300
- 14 Furman Lumber Inc. *
Hawk Furman
Rick Viola
Norman Gross
Boston, Mass
617-267-8700
- 15 George McQuestern Company Inc.
Peter Morebec
North Billerica, Mass.
617-663-3435
- 16 Grossman's Lumber
Dick Hunt
Westbrook, ME
207-797-6710
- 17 Grossman's Lumber *
Harvey Chanskey
Dick Farley
Boston, Mass.
617-848-0100
- 18 Jim Gillies Lumber Company Inc.
Mr. Gillies
Gray, ME
207-657-3318
- 19 Hardman Supply Company Inc.
Randall Walker
Spencer WV
304-927-4701
- 20 Martin's Paint Stores
Mr. Freund
Jamaica, NY
718-454-5100

- 21 Mullen Lumber
John Cartwell
Sudbury, Mass.
617-443-8901
- 22 National Association of Home Builders (NAHB)
Robert Villaneuva
Washington, DC
202-822-0237
- 23 NGM International *
Bob Neill
Herb Walsh
Jim Batt
Fredericton, NB
506-452-7000
- 24 North American Plywood Corporation
"Vinnie"
New York, NY
201-433-6358
- 25 Northeastern Lumberman's Association
Cindy Coolidge
Rochester, NY
716-325-1626
- 26 Peter Lumber
Mac Peter
Pleasantville, NJ
609-641-9000
- 27 P.F. O'Connor *
Joe Bruno
Austin O'Brien
Boston, Mass.
617-848-8190
- 28 P.F. O'Connor
Phil Cheney
South Yarmouth, MA
617-398-6026
- 29 P.F. O'Connor
Joe Rogers
Plymoth, Mass.
617-398-6026
- 30 Random Lengths
Judy Hussey
Eugene, Oregon

- 31 Rickel Home Centers
Bob Dimedio
Mike Friedman
200 Helen Street
South Plaine Field
201-668-7000
- 32 Somerville Lumber & Supply Company Inc.
Ed Lenahan, Jr.
Waltham, MA
617-829-2569
- 33 Triangle Lumber
"Larry"
Englishtown, NJ
201-446-3700
- 34 US Department of Commerce, Bureau of the Census
Bob Marshe
Washington, DC
301-763-4478
- 35 US Department of Commerce, Bureau of the Census
Clint Thomas
Washington, DC
301-763-5850
- 36 US Plywood Corporation
Joe Hochenberger
Wilton, CT
203-834-2000
- 37 W.R. Grace Company
Mike Grant
Rick Moore
New York, NY
212-819-5500
- 38 Wickes Companies Inc.
Paul Verchek
Saginaiv, MI
517-753-6408

Canadian Companies Contacted

- 1 Atlantic Building Supply Dealers Association (ABSDA)
John Ward
Moncton, NB
506-858-0700
- 2 Atlantic Waferboard *
Dave Shields
Ken Fry
Drew English
Chatham, NB
- 3 Canfor
Len Vallis
Bob LeMoyne
Halifax, NS
902-465-5600
- 4 Central Supplies Ltd.
Steve Smith
Antigonish, NS
902-863-6882
- 5 Chandler Bros. Ltd.
Stu Chandler
Charlottetown, PEI
902-892-6557
- 6 Customs Regional Office
Mr. McDonald
Halifax, NS
902-426-2662
- 7 Daigle Lumber
Paul Bourque
Moncton, NB
506-858-9220
- 8 Dartmouth Building Supplies Ltd.
John LaFlamme
Dartmouth, NS
902-434-9210
- 9 Diamond Building Products
Reg Diamond
Stephenville, Nfld.
709-643-5627

- 10 DRIE Wood Products Division
Jeff Serveau
Doug Shaw
Ottawa, Ont.
613-954-3039
- 11 East Coast Lumber
Marc Demers
Fredericton, NB
506-453-9800
- 12 Eddy Group
Hallet Winter
Bathurst, NB
506-546-6631
- 13 Kennebecasis Home Center
David Bishop
Hampton, NB
506-847-7533
- 14 Kent Building Supplies Head Office
Mr. McKay
Saint John, NB
506-657-7777
- 15 Landry, D.E. & Fils Ltée
Gerald Landry
St. Francois, NB
506-992-2125
- 16 Lockharts Ltd.
Dave Campbell
Moncton, NB
506-857-2260
- 17 MacCallum Building Supplies
Neil MacCallum
Chatham, NB
506-622-3771
- 18 Northwood Building Materials (Noranda)
Jill James
Al Lewis
Toronto, Ont.
416-365-0700
- 19 Piercey Supplies Ltd.
G.J. MacCulloch
Halifax, NS
902-454-6411

- 20 Piercy Supplies Ltd.
G.J. MacCulloch
Halifax, NS
902-454-6411
- 21 Provincial Lumber Ltd.
Mr. Duffy
Fredericton, NB
506-458-8175
- 22 Schurman Supply Ltd.
Charlie MacDonald
Summerside, PEI
902-436-7257
- 23 Schurman Supply Ltd.
Doug Molyneaux
Charlottetown, PEI
902-894-7315
- 24 Spracklins Building Supplies Ltd.
Gerald Spracklin
St. John's, Nfld.
709-643-5627
- 25 Stan Dawe Ltd.
Gerald Dawe
Cornerbrook, Nfld.
709-639-9131
- 26 Statistics Canada
Gordon Blaney
Ottawa, Ont.
613-990-9647
- 27 Sunset Building Supplies Ltd.
Jack Young
Woodstock, NB
506-328-8816
- 28 The Waferboard Association
Hank Ford
Geraldine Palmer
Don Mills, Ont.
416-445-3263
- 29 Topmar Building Supplies
John Mahar, Jr.
Fredericton, NB
506-452-1855

30 Wilkin's Building Supplies
Vaughn Wilkins
Fredericton, NB
506-459-3385

APPENDIX 3
COPY OF QUESTIONNAIRE

SISKIN MANAGEMENT INC.

File 1026/5.2

QUESTIONNAIRE: Market Research
NGM File 3961
N.B. Waferboard/OSB Study

DATE CONTACTED:

COMPANY CALLED:

COMPANY CATEGORY: Wholesaler/Retailer/Contractor/Other _____

PERSON CONTACTED:

ADDRESS:

PHONE NO.:

PHONE CALL/VISIT:

CALL MADE BY:

INTRODUCTION:

Our company is doing a marketing study on behalf of the Province of New Brunswick to evaluate the potential to build a new waferboard/OSB plant in the Province. As a part of this study, we are contacting retailers, wholesalers, and users of waferboard/OSB.

If possible, we would like to ask you a few questions about this market.

QUESTION:

1. (a) What size, thickness, finish (waferboard) do you sell?

	<u>Size</u>	<u>Finish</u>		
	<u>4 x 8</u>	<u>Other</u>	<u>Standard</u>	<u>Non Slip</u>
1/4"				
5/8"				
7/16"				
Other				

(b) Is there a demand for 4' x 9' sheets?

2. Of your total sales, what % is sold in each thickness?
(Respondent may say they don't know; look at number of lifts or carloads bought/month in each size. Exact numbers not important - looking for an order of magnitude).

<u>Thickness</u>	<u>%</u>	<u># Lifts/Month</u>
1/4"		
5/8" T&G		
7/16"		

3. What is important to the buyer/consumer in terms of price/quality/end use?

Price

Specifications

Availability

Appearance

Function

4. Are end users (builders/contractors, etc.) aware of the cost savings/benefits of using WB/OSB? (Compared to plywood.)

5. Do you think that the market for waferboard/OSB is growing or shrinking in relationship to the market for other structural plywood.

- (a) What is the ratio of your softwood plywood to waferboard/OSB sales? (Rough order of magnitude.)
- (b) If you compare this years with last years sales, do you see more 7/16" waferboard used for wall and roof sheathing on new home construction; and as a result are 1/2" standard spruce plywood sheathing sales decreasing?

What about 5/8" tongue and groove waferboard floor sheathing vs 5/8" tongue and groove select spruce sheathing?

- (c) Why does the buyer/consumer select waferboard rather than plywood?
- (d) Do builders prefer to use lumber rather than panel products for sheathing applications? Explain.
- (e) Do you see any long term trends?

6. What type of promotion is presently given to support waferboard/OSB sales?
7. How do you decide where to place an order for waferboard/OSB?
Existing Supplier
Price
Delivery
Availability
8. (a) When you buy, do you specify brand name or type of waferboard, or do you buy on price and take what you get?

(b) Do you pay a premium price for Oriented Structural Board?
9. Do you generally remain committed to a given supplier?

10. How often do you place orders for waferboard/OSB? (The order size would probably vary by season).
11. (a) What is your normal order size? Is there a minimum order size?

(b) Do you sell enough waferboard to buy in truckload quantities?
12. Is there a shortage of waferboard in your area?
13. Are you able to satisfy your customers' demand?
14. (Wholesalers) Is there room for another supplier of high quality waferboard/OSB?
15. What advice would you give to a new manufacturer of waferboard/OSB?
16. Other comments.

APPENDIX 4

DETAILED SURVEY RESULTS

WB					TOTAL	%	TOTAL	%
1	2	3	4	5				
					0	0	0	0.00%
1	1	1		1	4	0.8	10	40.00%
					0	0	9	36.00%
					0	0	0	0.00%
0.1					0.1	0.02	2.45	9.80%
0.1					0.18	0.036	0.93	3.72%
0.3	0.9	0.5			1.73	0.346	12.58	50.32%
					0	0	0	0.00%
	1	1	1	1	4	0.8	19	76.00%
					0	0	1	4.00%
					0	0	1	4.00%
		1			1	0.2	1	4.00%
					0	0	0	0.00%
					0	0	0	0.00%
1	1	1	1	1	4	0.8	16	64.00%
					0	0	3	12.00%
					0	0	0	0.00%
1	1	1	1	1	4	0.8	14	56.00%
					0	0	3	12.00%
					0	0	2	8.00%
					0	0	0	0.00%
0.1	0.0	0.0	0.0	0.3	0.5	0.1	3.07	12.28%
					0	0	0	0.00%
					0	0	0	0.00%
1	1	1	1	1	4	0.8	14	56.00%
					0	0	3	12.00%
					0	0	2	8.00%
					0	0	0	0.00%
		1			1	0.2	9	36.00%
					0	0	2	8.00%
	1				1	0.2	7	28.00%
					0	0	0	0.00%
		1			1	0.2	4	16.00%
	1				1	0.2	2	8.00%
					0	0	5	20.00%
1					1	0.2	10	40.00%
					0	0	0	0.00%
		1		1	2	0.4	8	32.00%
	1				1	0.2	6	24.00%
1					1	0.2	5	20.00%
					0	0	0	0.00%
1	1	1			3	0.6	16	64.00%
					0	0	3	12.00%
					0	0	0	0.00%
1		1			2	0.4	3	12.00%
					0	0	1	4.00%
					0	0	0	0.00%
					0	0	1	4.00%
1	1	1			3	0.6	17	68.00%
					0	0	0	0.00%
1					1	0.2	2	8.00%
	1	1			2	0.4	14	56.00%
					0	0	3	12.00%
					0	0	0	0.00%
				1	1	0.2	5	20.00%
1	1	1	1	1	4	0.8	17	68.00%
					0	0	0	0.00%
					0	0	0	0.00%
					0	0	0	0.00%
1	1	1	1	1	4	0.8	19	76.00%
					0	0	1	4.00%
					0	0	0	0.00%
		1			1	0.2	9	36.00%
1	1		1	1	4	0.8	12	48.00%
					0	0	4	16.00%

DEMAND FOR Y
4X9 SHEETS N
7

SALES 1/4"
ANALYSIS 5/8"
7/16"

IMPORTANT FACTORprice
TO BUYERS specs
delivery
brand
quality

CONSUMER AWARE OF
COST SAVINGS,OSB

SALES OF WB to increase
TOTAL PANEL same
SALES decrease

RATIO WB/TOTAL
PANEL SALES

WB SALES increase
same
decrease

WB IN WALLS/ increase
ROOFS same
decrease

WB IN FLOORS increase
same
decrease
?

LUMBER vs PANELST
N
?

HOW DO YOU DECIDprice
WHERE TO BUY avail
WB delivery
exst sup
quality

PAT PREMIUM \$ Y
FOR OSB N

REMAIN COMMITTED
TO EXISTING N
SUPPLIER

IS THERE A Y
SHORTAGE OF N
WB IN YOUR ?
AREA

CAN YOU SUPPLY Y
CUSTOMERS DEMAND

IS THERE ROOM Y
FOR ANOTHER OSB N
SUPPLIER ?

CANADA RETAIL

		NB									NS					PEI			NFL			TOTAL	%
		1	2	3	4	5	6	7	8	9	1	2	3	4	5	1	2	3	1	2	3		
DEMAND FOR 419 SHEETS	Y																					0	0.00%
	N	1								1	1							1		1		6	30.00%
	?		1			1	1	1				1	1	1				1	1			9	45.00%
																						0	0.00%
SALES	1/4"		0.5					0.5					0.1	0.4	0.6		0.2					2.35	11.75%
ANALYSIS	5/8"							0.2	0.3					0.2								0.75	3.75%
	7/16"		0.5	0.7	0.9			0.9	0.2	0.7	0.8	0.9	0.9	0.4	0.4		0.7	0.9		0.9	0.9	10.85	54.25%
																						0	0.00%
IMPORTANT FACTORS TO BUYERS	price	1	1	1	1			1	1	1	1	1	1	1	1		1		1	1		15	75.00%
	specs										1											1	5.00%
	delivery				1																	1	5.00%
	brand																					0	0.00%
	quality																					0	0.00%
																						0	0.00%
CONSUMER AWARE OF Y			1	1	1			1		1		1	1	1			1	1		1	1	12	60.00%
COST SAVINGS, OSB	N	1								1					1							3	15.00%
																						0	0.00%
																						0	0.00%
SALES OF WB TO TOTAL PANEL SALES	increase							1	1	1				1	1	1	1	1		1	1	10	50.00%
	same		1		1					1												3	15.00%
	decrease		1								1											2	10.00%
																						0	0.00%
RATIO WB/TOTAL PANEL SALES		0.4	0.2	0.2				0.3	0.1	0.1	0.2	0.1	0.2	0.1	0.2		0.0			0.3		2.57	12.85%
																						0	0.00%
WB SALES	increase							1	1	1				1	1	1	1	1		1	1	10	50.00%
	same		1		1					1												3	15.00%
	decrease		1								1											2	10.00%
																						0	0.00%
WB IN WALLS/ ROOFS	increase			1		1	1	1						1		1	1		1			8	40.00%
	same		1		1																	2	10.00%
	decrease		1							1	1	1	1	1								6	30.00%
																						0	0.00%
WB IN FLOORS	increase									1							1	1				3	15.00%
	same																			1		1	5.00%
	decrease					1	1	1		1				1								5	25.00%
	?	1	1	1	1						1		1	1			1	1				9	45.00%
																						0	0.00%
LUMBER vs PANELS	Y	1	1							1	1						1					6	30.00%
	N					1	1						1	1					1			5	25.00%
	?			1	1													1	1			4	20.00%
																						0	0.00%
HOW DO YOU DECIDE WHERE TO BUY WB	price	1	1	1	1			1	1	1	1	1	1	1					1			13	65.00%
	avail				1				1										1			3	15.00%
	delivery																					0	0.00%
	extat supp				1																	1	5.00%
	quality									1												1	5.00%
																						0	0.00%
PAY PREMIUM \$ FOR OSB	Y											1										1	5.00%
	N	1		1	1	1	1	1	1	1			1	1	1		1			1	1	14	70.00%
																						0	0.00%
REMAIN COMMITTED TO EXISTING SUPPLIER	Y									1												1	5.00%
	N	1	1	1	1			1	1		1		1	1					1	1		12	60.00%
						1												1				3	15.00%
																						0	0.00%
IS THERE A SHORTAGE OF WB IN YOUR AREA	Y					1				1				1					1			4	20.00%
	N	1	1	1	1			1	1		1		1				1	1	1		1	13	65.00%
	?																					0	0.00%
																						0	0.00%
CAN YOU SUPPLY CUSTOMERS DEMAND	Y	1	1	1	1	1	1	1	1	1	1		1				1	1	1		1	15	75.00%
	N																			1		1	5.00%
																						0	0.00%
IS THERE ROOM FOR ANOTHER OSB SUPPLIER	Y			1						1			1	1	1	1		1		1		8	40.00%
	N	1	1			1	1	1		1							1					8	40.00%
	?				1														1	1		4	20.00%

										TOT ALL			
										USA/CAN			
WB/USA				USA									
1	2	3	4	TOTAL	%								
				0	0.00%	DEMAND FOR	Y		2	4.55%	DEMAND FOR	Y	
1	1			2	50.00%	419 SHEETS	N		24	54.55%	419 SHEETS	N	
				0	0.00%		?		9	20.45%		?	
				0	0.00%				0	0.00%			
0.0	0.0	0.1		0.27	6.75%	SALES	1/4"		3.33	7.57%	SALES	1/4"	
0.1	0.0			0.18	4.50%	ANALYSIS	5/8"		1.13	2.57%	ANALYSIS	5/8"	
0.8	0.9	0.8	1	3.55	88.75%		7/16"		23.67	53.80%		7/16"	
				0	0.00%				0.23	0.52%			
1	1	1		3	75.00%	IMPORTANT FACTORS	price		32	72.73%	IMPORTANT FACTORS	price	
				0	0.00%	TO BUYERS	specs		1	2.27%	TO BUYERS	specs	
		1		1	25.00%		delivery		2	4.55%		delivery	
				0	0.00%		brand		2	4.55%		brand	
		1		1	25.00%		quality		3	6.82%		quality	
				0	0.00%				0	0.00%			
1	1		1	3	75.00%	CONSUMER AWARE OF	Y		29	65.91%	CONSUMER AWARE OF	Y	
		1		1	25.00%	COST SAVINGS,OSB	N		6	13.64%	COST SAVINGS,OSB	N	
				0	0.00%				0	0.00%			
		1		1	25.00%	SALES OF WB to	increase		22	50.00%	SALES OF WB to	increase	
		1		1	25.00%	TOTAL PANEL	same		5	11.36%	TOTAL PANEL	same	
1				1	25.00%	SALES	decrease		4	9.09%	SALES	decrease	
				0	0.00%				0	0.00%			
0.2	0.5			0.7	17.50%	RATIO WB/TOTAL			6.29	14.30%	RATIO WB/TOTAL		
				0	0.00%	PANEL SALES			0	0.00%	PANEL SALES		
				0	0.00%				0	0.00%			
				0	0.00%	WB SALES	increase		14	31.82%	WB SALES	increase	
				0	0.00%		same		3	6.82%		same	
				0	0.00%		decrease		2	4.55%		decrease	
				0	0.00%				0	0.00%			
		1		1	25.00%	WB IN WALLS/	increase		14	31.82%	WB IN WALLS/	increase	
	1			1	25.00%	ROOFS	same		6	13.64%	ROOFS	same	
1			1	2	50.00%		decrease		16	36.36%		decrease	
				0	0.00%				0	0.00%			
				0	0.00%	WB IN FLOORS	increase		7	15.91%	WB IN FLOORS	increase	
		1		1	25.00%		same		3	6.82%		same	
		1		1	25.00%		decrease		15	34.09%		decrease	
		1	1	2	50.00%		?		13	29.55%		?	
				0	0.00%				0	0.00%			
		1	1	2	50.00%	LUMBER vs PANELS	Y		12	27.27%	LUMBER vs PANELS	Y	
1	1			2	50.00%		N		19	43.18%		N	
				0	0.00%		?		7	15.91%		?	
				0	0.00%				0	0.00%			
1	1		1	3	75.00%	HOW DO YOU DECIDE	price		30	68.18%	HOW DO YOU DECIDE	price	
				0	0.00%	WHERE TO BUY	avail		3	6.82%	WHERE TO BUY	avail	
				0	0.00%	WB	delivery		3	6.82%	WB	delivery	
		1		1	25.00%		ext supp		6	13.64%		ext supp	
			1	1	25.00%		quality		5	11.36%		quality	
				0	0.00%				0	0.00%			
1	1		1	3	75.00%	PAY PREMIUM \$	Y		10	22.73%	PAY PREMIUM \$	Y	
		1		1	25.00%	FOR OSB	N		22	50.00%	FOR OSB	N	
				0	0.00%				0	0.00%			
		2		2	50.00%	REMAIN COMMITTED	Y		10	22.73%	REMAIN COMMITTED	Y	
1			1	2	50.00%	TO EXISTING	N		21	47.73%	TO EXISTING	N	
				0	0.00%	SUPPLIER			3	6.82%	SUPPLIER		
				0	0.00%				0	0.00%			
			1	1	25.00%	IS THERE A	Y		8	18.18%	IS THERE A	Y	
1	1	1		3	75.00%	SHORTAGE OF	N		31	70.45%	SHORTAGE OF	N	
				0	0.00%	WB IN YOUR	?		2	4.55%	WB IN YOUR	?	
				0	0.00%	AREA			0	0.00%	AREA		
				0	0.00%				0	0.00%			
1	1	1	1	4	100.00%	CAN YOU SUPPLY	Y		34	77.27%	CAN YOU SUPPLY	Y	
				0	0.00%	CUSTOMERS DEMAND	N		2	4.55%	CUSTOMERS DEMAND	N	
				0	0.00%				0	0.00%			
				0	0.00%	IS THERE ROOM	Y		16	36.36%	IS THERE ROOM	Y	
1	1		1	3	75.00%	FOR ANOTHER OSB	N		15	34.09%	FOR ANOTHER OSB	N	
				0	0.00%	SUPPLIER	?		10	22.73%	SUPPLIER	?	

		RETAIL/USA															TOTAL		%
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
DEMAND FOR 4X9 SHEETS	Y								1		1						2	13.33%	
	N	1		1	1	1	1	1		1		1	1	1	1	1	12	80.00%	
	?																0	0.00%	
SALES ANALYSIS	1/4"								0.1	0.0					0.3	0.0	0.61	4.07%	
	5/8"								0.0								0.02	0.13%	
	7/16"	0.9						0.9	0.8	0.9	0.8		1	0.8	0.6	0.7	7.54	50.27%	
																0.2	0.23	1.53%	
IMPORTANT FACTOR TO BUYERS	price	1			1			1	1		1	1	1	1		1	10	66.67%	
	specs																0	0.00%	
	delivery																0	0.00%	
	brand									1							1	6.67%	
	quality								1				1				2	13.33%	
CONSUMER AWARE OF COST SAVINGS, OGBM		1	1						1	1	1	1	1	1	1	1	10	66.67%	
				1				1									2	13.33%	
																	0	0.00%	
SALES OF WB TO TOTAL PANEL SALES	increase	1								1	1	1	1		1	1	7	46.67%	
	same												1				1	6.67%	
	decrease					1											1	6.67%	
																	0	0.00%	
RATIO WB/TOTAL PANEL SALES		0.2	0.0		0.0	0.0	0.0			0.2	0.6	0.2	0.3		0.4	0.3	2.52	16.80%	
																	0	0.00%	
																	0	0.00%	
WB SALES	increase																0	0.00%	
	same																0	0.00%	
	decrease																0	0.00%	
																	0	0.00%	
WB IN WALLS/ ROOFS	increase										1	1	1			1	4	26.67%	
	same									1				1		1	3	20.00%	
	decrease	1		1	1	1	1	1	1						1		7	46.67%	
																	0	0.00%	
WB IN FLOORS	increase										1	1				1	3	20.00%	
	same																0	0.00%	
	decrease	1		1	1	1	1	1	1				1	1		1	9	60.00%	
										1							1	6.67%	
																	0	0.00%	
LUMBER vs PANELS			1											1			2	13.33%	
	N	1		1	1	1	1	1		1	1	1			1	1	11	73.33%	
	?									1					1		2	13.33%	
																	0	0.00%	
HOW DO YOU DECIDE WHERE TO BUY WB	price	1						1	1	1	1	1	1	1	1	1	11	73.33%	
	avail																0	0.00%	
	delivery										1	1			1		3	20.00%	
	ext sup									1		1					2	13.33%	
	quality	1										1		1			3	20.00%	
																	0	0.00%	
PAY PREMIUM \$ FOR OGB	Y							1	1	1	1	1	1				6	40.00%	
	N													1	1	1	4	26.67%	
																	0	0.00%	
REMAIN COMMITTED TO EXISTING SUPPLIER		1							1		1		1		1	1	6	40.00%	
	N				1		1		1					1		1	5	33.33%	
																	0	0.00%	
																	0	0.00%	
IS THERE A SHORTAGE OF WB IN YOUR AREA	Y										1		1				2	13.33%	
	N	1		1	1		1	1	1		1			1	1	1	11	73.33%	
	?		1				1										2	13.33%	
																	0	0.00%	
																	0	0.00%	
CAN YOU SUPPLY CUSTOMERS DEMAND	Y	1		1			1	1	1		1	1	1	1	1	1	11	73.33%	
											1						1	6.67%	
																	0	0.00%	
IS THERE ROOM FOR ANOTHER OGB SUPPLIER	Y								1		1	1	1	1		1	7	46.67%	
	N																0	0.00%	
	?	1			4										1		6	40.00%	

APPENDIX 5

RESPONDENT'S COMMENTS

Survey Results Comments by Respondents

The following are direct quotes or observations that were obtained during interviews and visits with 50 wholesalers and retailers. Where company's or people's names are mentioned, comments were unsolicited by Siskin Management Inc.

Comments on eight key questions are addressed. The remarks are broken down according to, (a) Canada Wholesalers, (b) Canada Retailers, (c) USA Wholesalers, and (d) USA Retailers

1 Survey Results - Comments by Respondents

1.1

WHAT IS IMPORTANT TO THE BUYER/CONSUMER IN TERMS OF PRICE/ QUALITY/END USE?

1.1.1 Canada Wholesalers

- no brand name consciousness

1.1.2 Canada Retailers

- consumers not aware of brand names
- looking for durable but cheap panel for boarding in floors and houses
- looking for "Aspenite"
- price most important, then quality
- price most important - call for "shop grade"

1.1.3 USA Wholesalers

- price, quality, availability - oversupply at present
- price, delivery
- waferboard - price is most important; OSB - span rating, reputation, and product performance are most important
- brand name is the last thing people care about
- AWI and CP edge sealing all items; nice package, good water penetration

1.1.4 USA Retailers

- no brand name awareness regarding OSB/Waferboard
- contractors seem to prefer certain vendor's waferboard
- price - look for an alternative to plywood
- waferboard as percent of total panel sales is down
- price, quality, service same
- brand name consciousness
- quality and price equal value
- price is important to contractors

1.2 ARE END USERS (BUILDERS/CONTRACTORS, ETC.) AWARE OF THE COST SAVINGS/BENEFITS OF USING WB/OSB? (COMPARED TO PLYWOOD.)

1.2.1 Canada Wholesalers

- education process needed to make them realize that they aren't getting an inferior product
- yes, but big savings only to major builders
- aware, but not accepting. Still use (a) boards, then (b) plywood, then (c) waferboard
- yes, presently in market there is an over capacity; price of plywood to lumber is up; OSB to lumber is down

1.2.2 Canada Retailers

- aware of benefits/cost savings but inferior product
- if prices were the same they would use plywood
- contractors still prefer plywood (Douglas Fir, and N.B.Spruce) over waferboard
- this year, contractors seem to be using more plywood
- difficult to get builders to use waferboard - only used when they are putting up a cheap product or when plywood is scarce - "tried for years to get them to buy"
- they take time to educate their staff to explain differences to customers
- yes, but few builders are using waferboard
- yes, but OSB is used when plywood is not available

- there are problems with humidity in using waferboard

1.2.3 USA Wholesalers

- not as much as they should be

1.2.4 USA Retailers

- most contractors use plywood for new home construction
- a lot of waferboard is used on big construction jobs
- contractors have more faith in plywood
- end users aware of benefits but due to edge swell and buckling of past years, they are still resistant for using it for roofing applications
- common problems: it takes too long for blocking and bracing in corners
- when you staple the side wall with a staple gun to the waferboard, the back blows out of the waferboard
- end users are aware of the cost savings but are not willing to change from plywood to waferboard
- Waferboard/OSB not structurally better than plywood
- worried about moisture
- no contractors in the Plymouth area are using waferboard for home construction
- customers think waferboard cheapens the house
- contractors still don't use waferboard even though they could save several hundred dollars per house
- aware of savings but Maine is conservative and slow to change
- progressive builders are using waferboard to save money
- contractors equate price to quality
- contractors are very educated but may not know of benefits

1.3 DO YOU THINK THAT THE MARKET FOR WAFERBOARD/OSB IS GROWING OR SHRINKING IN RELATIONSHIP TO THE MARKET FOR PLYWOOD?

1.3.1 Canada Wholesalers

- 25% increase last year
- waferboard market fading away from plywood

- demand for plywood up; demand for waferboard up - but more in US than here

1.3.2 Canada Retailers

- reasonable growth - in cycles, depends on lumber and plywood prices
- lots of 2nd grade on the market
- not growing - staying the same, shortage of plywood
- no, not compared to last year's sales
- depends on plywood prices - when plywood price is down they use it
- waferboard increase not significant
- increasing market for OSB
- growing slowly - OSB not replacing plywood; plywood market not shrinking
- "appears" to be increasing

1.3.3 USA Wholesalers

- up to 2 months ago, more waferboard; now plywood is dominant
- demand for panels has leveled off in the last 3 years
- demand down

1.3.4 USA Retailers

- growing in Maine, acceptance much better in New Hampshire
- stable - past 3 years sales have been the same

1.4 DO YOU SEE ANY LONG TERM TRENDS?

1.4.1 Canada Wholesalers

- over time, OSB will become more of a market factor
- waferboard market will grow - less plywood
- depends on price of plywood; if plywood price were equal to OSB, they'd use plywood
- products carved out niches already

1.4.2 Canada Retailers

- waferboard is increasing but won't take over from plywood
- depends on plywood prices
- less usage of waferboard
- more and more waferboard will be used
- if plywood prices increase, demand for waferboard will increase
- OSB will increase - resources not unlimited
- waferboard is increasing slowly, almost no OSB is used here now
- no trend to use boards, more towards panel products
- OSB is the way to go; stability is a problem of the product
- depends on plywood supply and price - prefer plywood, superior product

1.4.3 USA Wholesalers

- long term - waferboard taking over
- OSB will work in slowly, at the expense of plywood
- very competitive
- doesn't understand why waferboard isn't doing better
- waferboard up as % of total sales in mid Atlantic States
- waferboard sales will fall as % total sales in Maine

1.4.4 USA Retailers

- people like OSB - no swelling, southern pine is plywood's problem
- future in "utility"
- industry has a hard time selling "standard" grade board
- people going back to plywood
- quantity problems - none with waferboard
- more OSB used than waferboard
- more waferboard
- ultimately use more produced in region because high cost of freight to bring in from the West

1.5

HOW DO YOU DECIDE WHERE TO PLACE AN ORDER FOR WAFERBOARD/OSB?

1.5.1 Canada Wholesalers

- No comments.

1.5.2 Canada Retailers

- if we can buy direct, we do
- price, existing supplier/manufacturer
- buying group
- if volume purchases, look at buying group
- volume quantities/low margins

1.5.3 USA Wholesalers

- quality; 5% of orders on open market - price
- look at prices - involves transportation costs

1.5.4 USA Retailers

- calls to major producers
- price/quality, stable supplier
- freight is biggest factor
- price and existing supplies important

1.6

WHEN YOU BUY, DO YOU SPECIFY BRAND NAME OR TYPE OF WAFERBOARD, OR DO YOU BUY ON PRICE AND TAKE WHAT YOU GET?

1.6.1 Canada Wholesalers

- only buy from a few mills, try to get best price
- consumers ask for "Aspenite" but take available, acceptable product
- soon all mills will be producing OSB at competitive prices

1.6.2 Canada Retailers

- specify price then brand name - price of OSB competitive with waferboard because of freight

- price of OSB is higher but they don't stock it
- not really but deal with MacMillan quite a lot
- pay premium for Super Roof from Aspenite
- brand name not important
- generally pay more for OSB

1.6.3 USA Wholesalers

- customers want MacMillan
- 3 methods that mill can sell: (a) sell themselves to retailers, (b) buying groups, and (c) limit distribution to suppliers
- clients specify brand name that they don't want

1.6.4 USA Retailers

- used to specify brand 8-10 years ago - wouldn't now
- 50% contractors say "don't ship this, send that..."
- not much occasion when people ask for OSB/waferboard in retail stores; lack of knowledge by retail customers; price too close
- buy from wholesales who hold position, don't buy lowest price
- specify brands they won't use

1.7 IS THERE ROOM FOR ANOTHER SUPPLIER OF HIGH QUALITY WAFERBOARD/OSB?

1.7.1 Canada Wholesalers

- a question of government subsidiaries - if viable without a subsidiary, yes
- enough Canadian products now
- need to rely on US for 50% production
- dependency on US may backfire
- potential for new US mills
- very competitive market

1.7.2 Canada Retailers

- if shortage, yes, but no problem with supply
- have to look at specific areas for sales

- if could be more price competitive, demand would support a new company
- depends on price/availability
- no room in New Brunswick
- try to sell regionally, give price discounts
- if high quality only
- if quality and competitive prices are there
- room if can get piece of pie - must consider that materials industry is seasonal

1.7.3 USA Wholesalers

- no, presently all suppliers are in the same area
- no, oversupply now

1.7.4 USA Retailers

- if cost competitive
- would like to see industry change to 24/16

1.8

WHAT ADVICE WOULD YOU GIVE TO A NEW MANUFACTURER OF WAFERBOARD/OSB?

1.8.1 Canada Wholesalers

- must determine how to market product (a) directly to retailer; (b) through major buying groups, Castle, etc.; and (c) Canfor, wholesalers play by par in district
- is there enough economical raw supply?
- disadvantage "cost and freight-wise" to get product to market
- sell to all wholesalers - develop loyalty among smaller groups
- overproduction now, don't go into business

1.8.2 Canada Retailers

- get good quality; zero in on number 1 line product; only occasionally sell shop grade; not a good future for OSB in this area; too much off grade sold (inconsistent sizes, thicknesses)

- give good quality at right price
- if they can make it cheaper then it is to their benefit
- depends on marketing, need to flexible with order size
- not enough market here, someone will have to shut down
- need good marketing support; would be very competitive; US quality not as good
- presently only buying four waferboard products, it is a price industry; buying groups play large part
- don't flood market with shop grade - keep quality high
- don't build empires on one good year's business; markets aren't there to support a new plant

1.8.3 USA Wholesalers

- keep quality high; rough surface 7/16"
- OSB is a growing industry; success depends on location and if they are service oriented
- be lowest cost producer or don't get into it

1.8.4 USA Retailers

- extremely price sensitive
- if marketing waferboard to contractor, have mock-up of system using waferboard (you could use it in contractor divisions)
- go right for customer and advertising
- product - price/service
- there is room; lot of weak marketing areas; aggressive sales force is needed
- no needs or demand
- with price differentiation
- biggest factor - edge swell
- good quality
- 2 things to control: (a) edge swelling, and (b) good screen - not so slippery

APPENDIX 6

CALCULATIONS, WAFERBOARD CONSUMPTION BY REGION

DETAILED CALCULATIONS
PANEL CONSUMPTION, N.A.

1986 BY REGION

	WEST	ONT/NC	SOUTH	AT/QUE/NE	
PLY USA	5500	3207	7289	3440	19436
PLY CAN	747	563	0	512	1823
TOT PLY	6248	3770	7289	3952	21259
	29.4%	17.7%	34.3%	18.6%	
WB USA	424	1314	1357	1145	4240
WB CAN	175	453	0	210	837
TOT WB	599	1767	1357	1354	5077
	11.8%	0.348033	0.267244	0.266785	
TOTAL	6847	5537	8645	5307	26336
	26.0%	21.0%	32.8%	20.2%	

1987 BY REGION

	WEST	ONT/NC	SOUTH	AT/QUE/NE	
PLY USA	5522	3220	7318	3454	19514
PLY CAN	735	554	0	504	1792
TOT PLY	6235	3761	7289	3944	21228
	29.4%	17.7%	34.3%	18.6%	
WB USA	476	1475	1522	1284	4757
WB CAN	188	487	0	226	900
TOT WB	664	1961	1522	1510	5657
	11.7%	0.346717	0.269069	0.266896	
TOTAL	6899	5722	8811	5454	26885
	25.7%	21.3%	32.8%	20.3%	

1988 BY REGION

	WEST	ONT/NC	SOUTH	AT/QUE/NE	
PLY USA	5544	3233	7347	3468	19592
PLY CAN	722	544	0	495	1762
TOT PLY	6223	3751	7289	3935	21198
	29.4%	17.7%	34.4%	18.6%	
WB USA	528	1638	1690	1426	5283
WB CAN	202	524	0	243	969
TOT WB	730	2161	1690	1669	6251
	11.7%	0.345743	0.270421	0.266978	
TOTAL	6953	5913	8979	5604	27449
	25.3%	21.5%	32.7%	20.4%	

APPENDIX 7

REPORT NO. NER-108 TECHNICAL SPECIFICATIONS



Council of American Building Officials

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS

5360 South Workman Mill Road
Whittier, California 90601

SECRETARIAT BUILDING OFFICIALS AND CODE ADMINISTRATORS INTERNATIONAL, INC.

4051 West Flossmoor Road
Country Club Hills, Illinois 60477

SOUTHERN BUILDING CODE CONGRESS INTERNATIONAL, INC.

900 Montclair Road
Birmingham, Alabama 35213

Report No. NER-108

Printed October, 1985

THIS REPORT IS SUBJECT TO
RE-EXAMINATION IN TWO YEARS

NATIONAL EVALUATION SERVICE COMMITTEE

APA STRUCTURAL-USE PANELS
AMERICAN PLYWOOD ASSOCIATION
POST OFFICE BOX 11700
TACOMA, WASHINGTON 98411

I. Subjects: 1. Compliance Assurance and/or Inspection Agency for APA Structural-Use Panels. 2. Use and Installation Specifications for APA Structural-Use Panels.

3. One-hour Fireresistive Floor/Ceiling Construction With APA Structural-Use Panels. 4. Tabulated Minimum Requirements For APA Rated Sheathing Plywood Wood Foundation Construction.

II. Description: Compliance Assurance and/or Inspection services are provided for manufacturer's of APA Structural-Use Panels as identified in the following categories.

APA Rated Sturd-I-Floor is manufactured in thicknesses from $19/32$ through $1\frac{1}{4}$ inch. Face ply (if veneer) and the ply adjacent to the face (if veneer) shall meet the applicable requirements of PS 1-83 for underlayment grade. Veneer faces are touch-sanded and the backs may be unsanded, touch-sanded, or textured. All-veneer panels conforming to PS 1-83 shall have a minimum face and back veneer thickness for the species group and minimum panel thickness as set forth in Table No. II. Other panels, in addition to meeting the performance requirements in Section B below, shall have minimum dry EA* values per foot of panel (for stress parallel to framing) of 1,100,000 pounds for span ratings of 16 o.c. and 20 o.c., and 1,500,000 pounds for 24 o.c.

* E = MOE per ASTM D3043, Method C, in pounds per square inch.
A = 12 times panel thickness in inches.

APA Rated Sheathing is manufactured with subfloor span ratings of 16, 20, and 24 inches and roof span ratings of 16, 20, 24, 32, 40, and 48 inches, or wall span ratings of 16 or 24 inches. The span rating is determined on the basis of the results of performance tests as noted in Section B. Panels which are required to have nails spaced closer than 6 inches at panel edges to meet the performance requirements are required to have this information included in the trademark.

A. COMPOSITION: 1. **Veneer:** Veneer used in structural-use panels meets the applicable requirements of U.S. Product Standard PS 1-83. Veneer not meeting the requirements of PS 1-83 may be used, provided the panels meet the applicable performance requirements. Veneer is used throughout the all-veneer panels and for face and back plies or inner layers in composite panels.

2. **Reconstituted Wood:** Other raw material used in panel manufacture is primarily produced from wood. Panels composed entirely of reconstituted wood are typically referred to as flakeboard, waferboard, oriented strandboard and particleboard. The panels are manufactured to specifications evaluated and deemed alternates to ANSI A208.1 (U.B.C. Standard No. 25-25). Application details must comply with this report.

B. PERFORMANCE REQUIREMENTS*: 1. **Structural Performance:** Structural-use panels meet performance requirements established by the American Plywood Association for concentrated, impact, and uniform loads for the end use span on the trademark. Panels are tested dry, wetted and redried and, for certain loading conditions, wet. Load test requirements are given in Table No. I. Panels may be used at roof spans with live loads not to exceed those given in Table No. VI and dead loads not to exceed 10 psf. Panels may be used at the rated floor span, with a live load not to exceed 85 psf and a dead load not to exceed 25 psf, except the Sturd-I-Floor panel with a span rating of 48" o.c. which is limited to a total floor load of 65 psf.

* The performance requirements established by APA are an acceptable alternative to ANSI A208.1 (U.B.C. Standard No. 25-25).

2. **Physical Properties:** Structural-use panels are evaluated for linear expansion.

3. **Panel Durability:** Structural-use panels are manufactured using a resin bonding system. All-veneer panels meeting all applicable requirements for Exterior-type plywood in U.S. Product Standard PS 1-83 are identified as Exterior-type and may be permanently exposed in outdoor applications and wood foundations (See Part IV). Other panels are

This report is limited to the specific product and data and test reports submitted by the applicant in its application requesting this report. No independent tests were performed by the National Evaluation Service Committee, and the committee specifically does not make any warranty, either expressed or implied, as to any finding or other matter in this report or as to any product covered by this report. This disclaimer includes, but is not limited to, merchantability. This report is also subject to the limitations listed herein.

identified as Exposure 1 or 2 and are not intended for permanent exposure. They may be used for roof sheathing, subflooring, combination subfloor-underlayment, or wall sheathing and must be covered with a suitable roof covering or exterior wall covering. Panels identified as Exposure 1 may be used for roof sheathing where exposed on the underside such as on eaves.

C. PANELS: 1. **Size:** Panels are generally produced in nominal sizes of 4 feet by 8 feet. Length and width tolerances are ± 0 , $-\frac{1}{8}$ inch.

2. **Tongue-and-groove Joints:** Panels may have tongue-and-groove joints on the 8-foot sides, 4-foot ends, or both. For $\frac{19}{32}$ -inch through $\frac{3}{4}$ -inch thicknesses, the tongue shall be $\frac{3}{8}$ inch long and contain a shoulder nominally $\frac{1}{4}$ inch long with a $\frac{1}{4}$ -inch tapered end. The groove shall be a female counterpart except that the tapered portion is $\frac{1}{16}$ inch deep. A tolerance of 0.010 inch shall be maintained. Other profiles may be used, provided structural performance tests were conducted on panels with that profile.

For $\frac{1}{4}$ -inch panels, the tongue shall be nominally $\frac{3}{8}$ inch long and contain a shoulder nominally $\frac{3}{16}$ inch long and an $\frac{1}{16}$ -inch tapered end. The groove shall be a female counterpart except that the tapered portion is $\frac{3}{4}$ -inch deep. A tolerance of 0.015 inch is maintained.

D. INSTALLATION: 1. **General:** All panels used for floors and roofs shall be installed over two or more spans, with the long dimension perpendicular to supports spaced in accordance with the span rating. Where the strong panel direction is not parallel to the long dimension, panels shall be so identified and shall be installed accordingly. All panels shall be installed with a $\frac{1}{8}$ -inch gap along all panel edges. A $\frac{1}{2}$ -inch gap shall be provided between the panel and concrete or masonry walls. Cutouts for plumbing and electrical shall be oversized.

Framing members shall properly align with the panel surface. Square-edged panels used for floors shall be covered with one of the following:

- 1) $\frac{1}{4}$ -inch or thicker underlayment.
- 2) $1\frac{1}{2}$ inches of cellular or lightweight concrete.
- 3) $\frac{25}{32}$ -inch wood strip finish flooring.

or the edges shall be supported with blocking.

Fasteners shall be located $\frac{3}{4}$ inch from panel edges.

2. **APA Rated Sturd-I-Floor:** Panel end joints shall be staggered. Ring- or screw-shank nails are used to attach APA Rated Sturd-I-Floor panels to supports — 6-penny for thicknesses through $\frac{3}{4}$ inch and 8-penny for greater thicknesses. Nails are spaced a maximum of 6 inches on center along panel edges and 10 inches on center along intermediate supports except that for 48-inch spans the maximum spacing is 6 inches along intermediate supports. APA Rated Sturd-I-Floor panels having nonveneer faces and intended for use under nontextile resilient flooring shall be covered with $\frac{1}{4}$ -inch minimum thickness underlayment, unless otherwise recommended by panel manufacturer.

If panels are field glued with an adhesive meeting APA Specification AFG-01 applied to joists and tongue-and-groove edges, nails may be spaced a maximum of 12 inches along all bearings for panels $\frac{3}{4}$ inch or less, and 6 inches for thicker panels, except 10 inches at intermediate supports which are 32 inches on center or less. Framing shall be free of surface moisture, dirt, cement, and other foreign materials.

Adhesives shall be applied in accordance with conditions designated by the adhesive manufacturer. One-fourth-inch-diameter beads of the adhesive are applied to each joist or blocking member, except two $\frac{1}{4}$ -inch-diameter beads are applied where panels abut on a joist. Tongue-and-groove joints are also glued. The panels must be applied within the time limit designated by the adhesive manufacturer. Where diaphragm action is required, the nail size and spacing shall be as set forth in Table No. IV. Spans for glued floors shall be limited as set forth in Table No. III.

If panels are square edged and a resilient floor covering is to be applied directly, panel edges shall be supported by 2-inch lumber blocking. Where panels are covered with a $\frac{1}{4}$ -inch minimum thickness underlayment or have tongue-and-groove edges, blocking is not required except if required by Table No. IV.

3. **APA Rated Sheathing:** Panels used for wall sheathing may be installed with the long panel dimension either perpendicular or parallel to studs. Panels rated for wall spans shall be installed over studs spaced no farther apart than the span rating. When panels rated for roof spans are used for wall sheathing, the maximum stud spacing is 16 inches for panels with ratings of 16 and 20 inches, and 24 inches for 24-inch and greater span ratings. Panels used for wall sheathing may be considered water-repellent panel sheathing under the code. The panels must be covered by an exterior wall covering complying with the code, as noted in Paragraph II-B-3.

Allowable live loads for panels used for roof sheathing with long panel dimension across supports are given in Table No. VI. Use panel edge clips at unsupported edges if required by Table No. VI.

Allowable live loads for panels used for roof sheathing applied with the long panel dimension parallel to supports are given in Table No. VII.

Panels $\frac{1}{2}$ -inch and less are fastened with 6-penny common nails; 8-penny are used for thicker panels. Nails are spaced 6 inches on center at panel edges supported by framing and 12 inches on center at other supports (10 inches for subfloors), except 6 inches on center when supports are spaced 48 inches on center. Closer nail spacing, if required, is marked on the panel.

Staples used for attaching Rated Sheathing to framing shall be as approved for plywood of the same thickness.

Rated Sheathing Panels with a minimum nominal thickness of $\frac{15}{32}$ inch and a minimum span rating of $\frac{32}{16}$ may be used in lieu of $\frac{1}{4}$ -inch-thick plywood under Classes A and B roofs as specified in the codes.

When used in diaphragm construction, structural-use panels are assigned the values in Table No. IV. The unblocked values shown also apply to panels having tongue-and-groove joints along the longitudinal edges.

One and one-eighth-inch APA Rated Sturd-I-Floor panels fastened with 8-penny ring- or screw-shank nails or 10-penny common nails are assigned the values for 10-penny common nails and $\frac{19}{32}$ inch minimum nominal veneer-faced panel thickness in Table No. IV. Where blocked values are required, 1-inch by $\frac{3}{4}$ -inch crown by No. 16 gauge staples shall be driven through the tongue-and-groove edges $\frac{1}{2}$ inch from the joint and driven so as to penetrate the tongue.

Staples shall be spaced at one half of the boundary nail spacing for Cases 1 and 2, and at one third the boundary nail spacing for Case 3, as illustrated in Figure No. 4.

When used in shear walls, structural-use panels are assigned the values in Table No. V.

For purposes of determining seismic forces for design, the horizontal force factor K may be taken as 1.0 for buildings not more than three stories in height with stud wall framing and using Rated Sheathing or Rated Sturd-I-Floor for the shear walls and diaphragms for the lateral force system.

III. One-hour Fireresistive Floor-Ceiling Construction:

In one-hour fireresistive construction, 1 1/4-inch APA Rated Sturd-I-Floor 48 inches on center "2-4-1" may be substituted for the double wood floor required by the code for one-hour wood floor construction.

In one-hour fireresistive construction, 1 1/2-inch or thicker APA Rated Sturd-I-Floor panels are equivalent to the 1 1/2-inch or 3/4-inch plywood or particleboard underlayment required by the code.

- * The following floor-ceiling assemblies as listed in the January 1984 UL Fire Resistance Directory may be constructed with 7/16" 24/16 Rated Sheathing (nonveneer) in lieu of 1/2" 32/16 Rated Sheathing (plywood). In these assemblies other nonveneer panels may be substituted for the same thickness plywood panels.

L001	L211	L518
L003	L212	L519
L004	L501	L522
L005	L502	L524
L006	L503	L525
L201	L505	L526
L202	L511	L528
L204	L512	L529
L206	L513	L530
L209	L514	L531
L210	L515	

IV. Wood Foundations: All-veneer APA Rated Sheathing Panels identified with PS I-83 and C-D INT/EXT Glue or C-D Exposure 1 in the trademark may be used for wood foundation wall sheathing at thicknesses not less than those given in Table No. VIII. The details in the table are based on walls retaining drained earth, having a pressure equivalent to that exerted by a fluid weighing not more than 30 pounds per cubic foot, and having a depth equal to that of the retained earth.

The panels' pressure-preservative treatment and marking, in accordance with code requirements for wood foundations, is outside of the scope of this report.

V. Identification: All APA Structural-use panels shall be identified with an APA trademark bearing the APA Rated Sturd-I-Floor or APA Rated Sheathing notation, the National Evaluation Service report number, the nominal panel thickness and the span rating. Example trademarks are included in Figure Nos. 1 through 3. Exterior-type plywood structural-use panels, conforming to the requirements of Product Standard PS I-83 may be identified as shown in Figure No. 3.

VI. Evidence Submitted: The following is submitted:

1. APA Research Report 135-C entitled "Test Methods and Performance Requirements for Floor and Roof Sheathing."
2. Calculations of plywood section properties and allowable loads.
3. APA quality control manual.
4. APA Specification and Policy for Structural-Use Panel Sheathing.
5. Fire test investigations performed by Underwriters Laboratories and Warnock-Hersey.

VII. Findings: The National Evaluation Service Committee finds that American Plywood Association be recognized as a Compliance Assurance and/or Inspection Agency for APA Structural-Use Panels in accordance with this report and that the APA Quality Control Manual defines an acceptable program under the 1984 BOCA Basic/National Building Code and 1985 Supplement, the 1985 Standard Building Code, and the 1985 Uniform Building Code, subject to the following conditions:

1. This report is only an evaluation of the American Plywood Association as an independent quality control agency for APA Structural-Use Panels. The product may be accepted by the local authority having jurisdiction based on data generated by the American Plywood Association when such data indicates code compliance.
2. The program for panel fabrication and installation complies with the criteria set forth in this report.

This report is subject to re-examination in two years.

APA
RATED STURD-I-FLOOR
20 OC 19/32 INCH
 SIZED FOR SPACING
 T&G NET WIDTH 47-1/2
EXPOSURE 1
000
 NER-108

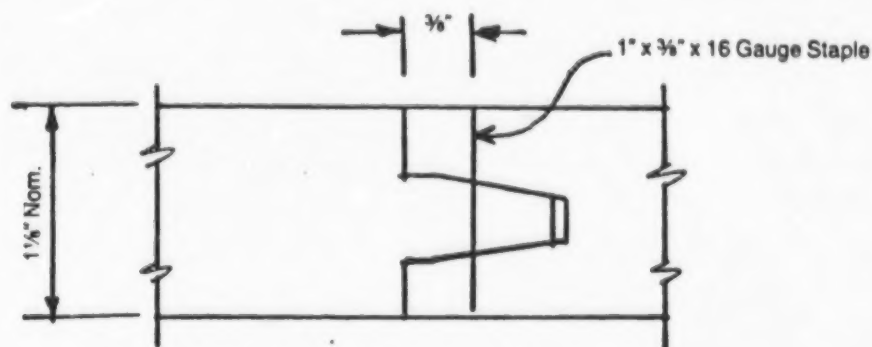
FIGURE NO. 1

APA
RATED SHEATHING
32/16 15/32 INCH—Thickness
 SIZED FOR SPACING
EXPOSURE 1
000—Mill number
 NER-108—Evaluation number

FIGURE NO. 2

APA
RATED SHEATHING
40/20 19/32 INCH
 SIZED FOR SPACING
EXTERIOR
000
 PS 1-83 C-C NER-108

FIGURE NO. 3



DETAIL OF STAPLE IN TONGUE-AND-GROOVE JOINT
 OF ALL-VENEER 48 O.C. STURD-I-FLOOR

FIGURE NO. 4

TABLE NO. I—STRUCTURAL PERFORMANCE REQUIREMENTS
 (Minimum Ultimate Loads)

PRODUCT AND CONDITION ¹	CONCENTRATED LOAD (lb.)	CONCENTRATED LOAD AFTER 75 FT.-LB. IMPACT (lb.)	UNIFORM LOAD (psf)
APA Rated Sturd-I-Floor Dry or Wet/Redry	550	400	330
APA Rated Sheathing Roof Dry	400	300	150
Wet	400	300	2
Subfloor Dry or Wet/Redry	400	400	330

¹Wet/redry is exposure to three days continuous wetting followed by testing dry. Wet conditioning is exposure to three days continuous wetting and tested wet.

²Not applicable.

TABLE NO. II—ALL-VENEER RATED STURD-I-FLOOR PANEL THICKNESS AND VENEER REQUIREMENTS FOR SPAN RATING AND PS-1 SPECIES GROUP

SPAN RATING	NOMINAL PANEL THICKNESS (in inches)	MINIMUM NUMBER OF PLIES—LAYERS	MINIMUM FACE AND BACK VENEER THICKNESS BEFORE SANDING FOR PS-1 SPECIES GROUP (in inches)				INNER PLY SPECIES GROUP
			1	2	3	4	
16	1 9/16	4-3	(1)	(1)	(1)	1/4	1, 2, 3 or 4
	3/4	4-3	(1)	(1)	(1)	(1)	1, 2, 3 or 4
20	1 9/16	4-3	(1)	1/4	(2)	(2)	1, 2, 3 or 4
	3/4	4-3	(1)	1/4	1/4	(2)	1, 2, 3 or 4
	7/16	4-3	1/16	1/16	1/16	1/4	1, 2, 3 or 4
	3/4	4-3	1/16	1/16	1/16	1/16	1, 2, 3 or 4
24	7/16	4-3	1/16	1/4	1/4	(2)	1, 2, 3 or 4
	3/4	4-3	1/16	1/4	1/4	(2)	1, 2, 3 or 4
	3/4	5-5	1/16	1/16	1/16	1/4	1, 2, 3 or 4
48	1 1/4	7-5	1/4	1/4	(2)	(2)	1 or 2
	1 1/4	7-5	1/4	1/4	(2)	(2)	1, 2 or 3
	1 1/4	7-7	1/16	1/4	1/4	(2)	1
	1 1/4	7-7	1/4	1/4	1/4	(2)	1, 2 or 3

(1) 1/4-inch minimum for 1, 4 and 5-ply 1-layer panels. May be 1/16-inch minimum for 5-ply 5-layer panels.

TABLE NO. III—APA GLUED FLOOR SYSTEM MAXIMUM JOIST SPANS¹

SPECIES & GRADE OF JOIST	JOIST SIZE	JOISTS @ 16" o.c.			JOISTS @ 19.2" o.c.		JOISTS @ 24" o.c.
		1 1/2" 24/19 ²	1 3/4" Sturd-I-Floor ³	1 7/8" Sturd-I-Floor ⁴	1 3/4" Sturd-I-Floor ³	1 7/8" Sturd-I-Floor ³	1 7/8" Sturd-I-Floor ³
Douglas Fir-Larch No. 1	2 x 6	10-7	11-0	11-4	10-6	10-6	9-5
	2 x 8	13-9	14-3	14-7	13-7	13-10	12-5
	2 x 10	17-6	17-11	18-3	17-0	17-4	15-10
	2 x 12	21-2	21-7	21-11	20-6	20-10	19-3
Douglas Fir-Larch No. 2	2 x 6	10-5	10-6	10-6	9-7	9-7	8-7
	2 x 8	13-7	13-10	13-10	12-7	12-7	11-3
	2 x 10	17-2	17-7	17-7	16-1	16-1	14-5
	2 x 12	20-9	21-3	21-5	19-7	19-7	17-6
Douglas Fir-South No. 1	2 x 6	9-10	10-4	10-8	9-11	10-2	9-1
	2 x 8	12-9	13-4	13-8	12-8	13-0	12-0
	2 x 10	16-2	16-8	17-0	15-11	16-3	15-4
	2 x 12	19-7	20-1	20-5	19-1	19-5	18-4
Douglas Fir-South No. 2	2 x 6	9-7	10-1	10-1	9-3	9-3	8-3
	2 x 8	12-6	13-1	13-4	12-2	12-2	10-11
	2 x 10	15-10	16-4	16-8	15-6	15-6	13-11
	2 x 12	19-1	19-8	20-0	18-8	18-10	16-11
Hem-Fir No. 1	2 x 6	10-0	10-3	10-3	9-5	9-5	8-5
	2 x 8	13-1	13-7	13-7	12-5	12-5	11-1
	2 x 10	16-6	17-0	17-4	15-10	15-10	14-2
	2 x 12	20-0	20-6	20-10	19-3	19-3	17-2
Hem-Fir No. 2	2 x 6	9-4	9-4	9-4	8-6	8-6	7-7
	2 x 8	12-4	12-4	12-4	11-3	11-3	10-0
	2 x 10	15-8	15-8	15-8	14-4	14-4	12-10
	2 x 12	19-1	19-1	19-1	17-5	17-5	15-7
Mountain Hemlock No. 2	2 x 6	9-2	9-6	9-6	8-8	8-8	7-9
	2 x 8	11-11	12-6	12-7	11-6	11-6	10-3
	2 x 10	15-0	15-8	16-0	14-8	14-8	13-1
	2 x 12	18-2	18-9	19-2	17-9	17-9	15-11
Mountain Hemlock-Hem Fir No. 2	2 x 6	9-2	9-4	9-4	8-6	8-6	7-7
	2 x 8	11-11	12-4	12-4	11-3	11-3	10-0
	2 x 10	15-0	15-8	15-8	14-4	14-4	12-10
	2 x 12	18-2	18-9	19-1	17-5	17-5	15-7
Western Hemlock No. 1	2 x 6	10-2	10-8	10-10	9-11	9-11	8-10
	2 x 8	13-4	13-10	14-1	13-0	13-0	11-8
	2 x 10	16-10	17-4	17-8	16-6	16-7	14-10
	2 x 12	20-5	20-11	21-2	19-10	20-2	18-1
Lodgepole Pine No. 2	2 x 6	8-11	8-11	8-11	8-2	8-2	7-3
	2 x 8	11-9	11-9	11-9	10-9	10-9	9-7
	2 x 10	15-0	15-0	15-0	13-8	13-8	12-3
	2 x 12	18-3	18-3	18-3	16-8	16-8	14-11
Western Cedar No. 2	2 x 6	8-11	8-11	8-11	8-2	8-2	7-3
	2 x 8	11-7	11-9	11-9	10-9	10-9	9-7
	2 x 10	14-7	15-0	15-0	13-8	13-8	12-3
	2 x 12	17-8	18-3	18-3	16-8	16-8	14-11
Southern Pine (KD) No. 1	2 x 6	10-7	11-0	11-4	10-6	10-10	9-8
	2 x 8	13-9	14-3	14-7	13-7	13-11	12-9
	2 x 10	17-6	17-11	18-3	17-0	17-4	16-3
	2 x 12	21-2	21-7	21-11	20-6	20-10	19-7
Southern Pine (KD) No. 2	2 x 6	10-2	10-8	10-8	9-9	9-9	8-8
	2 x 8	13-4	13-10	14-0	12-10	12-10	11-6
	2 x 10	16-10	17-4	17-8	16-4	16-4	14-8
	2 x 12	20-5	20-11	21-2	19-10	19-11	17-9

¹Based on live load of 40 psf, total load of 50 psf, deflection limited to $1/160$ of span at 40 psf.²These spans based on edge joints in plywood not glued and not blocked.³Glue tongue-and-groove joints. If square-edge panels are used, block panel edges and glue panels to joists and blocking.

TABLE NO. IV—ALLOWABLE SHEAR (POUNDS PER FOOT) FOR HORIZONTAL APA STRUCTURAL-USE PANEL DIAPHRAGMS WITH FRAMING OF DOUGLAS FIR, LARCH OR SOUTHERN PINE¹ FOR WIND OR SEISMIC LOADING

PANEL GRADE	COMMON NAIL SIZE	MINIMUM NAIL PENETRATION IN FRAMING (Inches)	MINIMUM NOMINAL PANEL THICKNESS (Inch)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBER	BLOCKED DIAPHRAGMS				UNBLOCKED DIAPHRAGMS			
					Nail Spacing (In.) at Diaphragm Boundaries (All Cases) at Continuous Panel Edges Parallel to Load (Cases 3 and 4) ²				Nails Spaced 6" Max. at Supported Edges ³			
					8		4		2½ ²		2 ²	
					Nail Spacing (In.) at Other Panel Edges				Case 1 (No Unblocked Edges or Continuous Joints Parallel to Load)		All Other Configurations (Cases 2, 3 and 4)	
					8		4		8		4	
APA STRUCTURAL RATED SHEATHING, STURD-I-FLOOR EXP I OR EXT	6d	1¼	¾	2	185	250	375	420	165	125		
				3	210	280	420	475	185	140		
	8d	1½	¾	2	270	360	530	600	240	180		
				3	300	400	600	675	265	200		
	10d	1¾	1½	2	320	425	640	730	285	215		
				3	360	480	720	820	320	240		
APA RATED SHEATHING, STURD-I-FLOOR EXP I, EXP 2 OR EXT; APA STRUCTURAL RATED SHEATHING EXP I OR EXT	6d	1¼	¾	2	170	225	335	380	150	110		
				3	190	250	380	430	170	125		
			¾	2	185	250	375	420	165	125		
				3	210	280	420	475	185	140		
	8d	1½	¾	2	240	320	480	545	215	160		
				3	270	360	540	610	240	180		
			¾	2	255	340	505	575	230	170		
				3	285	380	570	645	255	190		
			1½	2	270	360	530	600	240	180		
			3	300	400	600	675	265	200			
	10d	1¾	1½	2	290	385	575	655	255	190		
				3	325	430	650	735	290	215		
			1½	2	320	425	640	730	285	215		
				3	360	480	720	820	320	240		

¹For framing of other species: (a) Find species group of lumber in NFPA National Design Specifications; (b) find shear value from table for nail size, and for Structural I panels (regardless of actual grade); (c) multiply value by 0.82 for Lumber Group III or 0.65 for Lumber Group IV.

²Space nails 12 inches o.c. along intermediate framing members for roofs, and 10 inches o.c. for floors (6 inches o.c. when supports are spaced 48 inches o.c.).

³Framing at panel edges shall be 3-inch nominal or wider and nails shall be staggered where nails are spaced 2 inches or 2½ inches o.c., and where 10d nails having penetration into framing of more than 1½ inches are spaced 3 inches o.c.

Exception: Unless otherwise required, 2-inch nominal framing may be used where full nailing surface width is available and nails are staggered.

⁴1/2 veneer panel

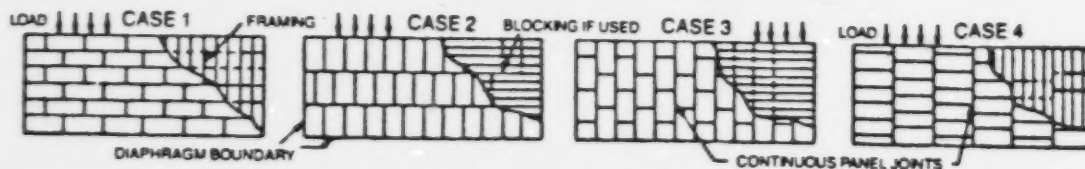


TABLE NO. V—ALLOWABLE SHEAR (POUNDS PER FOOT) FOR APA STRUCTURAL-USE PANEL SHEAR WALLS WITH FRAMING OF DOUGLAS FIR, LARCH OR SOUTHERN PINE FOR WIND OR SEISMIC LOADING^{1, 2, 3}

PANEL GRADE	MINIMUM NOMINAL PANEL THICKNESS (Inch)	MINIMUM NAIL PENETRATION IN FRAMING (Inches)	PANELS APPLIED DIRECT TO FRAMING				PANELS APPLIED OVER 1/2" GYPSUM SHEATHING						
			Nail Size (Common or Galvanized Box)	Nail Spacing at Panel Edges (In.)				Nail Size (Common or Galvanized Box)	Nail Spacing at Panel Edges (In.)				
				8	4	3	2 ²		8	4	3	2 ²	
APA STRUCTURAL I ⁶ RATED SHEATHING EXP I OR EXT	3/16	1 1/4	6d	200	300	390	510	8d	200	300	390	510	
	1/8	1 1/4	8d	230 ⁴	360 ⁴	460 ⁴	610 ⁴	10d	280	430	550 ³	730	
	7/16			255 ⁴	395 ⁴	505 ⁴	670 ⁴						
	1 3/32			280	430	550	730						
	1 3/32	1 3/4	10d	340	510	665 ³	870	—	—	—	—	—	
APA RATED SHEATHING EXP I, EXP 2 OR EXT; APA STRUCTURAL II RATED SHEATHING EXP I OR EXT	3/16	1 1/4	6d	180	270	350	450	8d	180	270	350	450	
	1/8			200	300	390	510		200	300	390	510	
	3/4			220 ⁴	320 ⁴	410 ⁴	530 ⁴		10d	260	380	490 ³	640
	7/16	240 ⁴	350 ⁴	450 ⁴	585 ⁴								
	1 3/32	260	380	490	640								
		1 3/32	1 3/4	10d	310	460	600 ³	770	—	—	—	—	—
	1 9/32	340			510	665 ³	870						

¹For framing of other species: (a) Find species group of lumber in the NFPA National Design Specifications; (b) find shear value from table for nail size, and for STRUCTURAL I panels (regardless of actual grade); (c) multiply this value by 0.82 for Lumber Group II or 0.65 for Lumber Group IV.

²All panel edges backed with 2-inch nominal or wider framing. Install panels either horizontally or vertically. Space nails 6 inches o.c. along intermediate framing members for ¾-inch and 1½-inch panels installed on studs spaced 24 inches o.c. For other conditions and panel thicknesses, space nails 12 inches o.c. on intermediate supports.

³Framing at panel edges shall be 3-inch nominal or wider and nails shall be staggered where nails are spaced 2 inches o.c., and where 10d nails having penetration into framing of more than 1½ inches are spaced 3 inches o.c.

Exception: Unless otherwise required, 2-inch nominal framing may be used where full nailing surface width is available and nails are staggered.

⁴Shear may be increased to values shown for 1½-inch sheathing with same nailing, provided (1) studs are spaced a maximum of 16 inches o.c. or (2) if panels are applied with long dimension across studs.

⁵These values are for short-time loads due to wind or earthquake and must be reduced by 25 percent for normal loading.

TABLE NO. VI — ALLOWABLE UNIFORM ROOF LIVE LOADS FOR APA RATED SHEATHING AND APA RATED STURD-I-FLOOR WITH LONG DIMENSION PERPENDICULAR TO SUPPORTS^a

APA RATED SHEATHING		ROOF										FLOOR
SPAN RATING	PANEL THICKNESS	MAXIMUM SPAN (Inches)		ALLOWABLE LIVE LOADS (psf)								MAXIMUM SPAN (Inches)
		With Edge Support ^b	Without Edge Support	Spacing of Supports Center-to-Center (Inches)								
				12	16	20	24	32	40	48	60	
Roof/Floor Span	(Inch)											
12/0	3/16	12	12	30								0
16/0	3/16, 3/8	16	16	55	30							0
20/0	3/16, 3/8	20	20	70	50	30						0
24/0	3/8, 7/16, 1/2	24	20 ^c	90	65	55	30					0
24/16	7/16, 1/2	24	24	135	100	75	40					16
32/16	13/32, 1/2, 3/4	32	28	135	100	75	55	30				16 ^d
40/20	9/16, 13/32, 3/4, 7/8, 1	40	32	165	120	100	75	55	30			20 ^{d, e}
48/24	23/32, 3/4, 7/8	48	36	210	155	130	100	65	50	35		24

APA RATED STURD-I-FLOOR		ROOF										
SPAN RATING	PANEL THICKNESS	MAXIMUM SPAN (Inches)		ALLOWABLE LIVE LOADS (psf)								
		With Edge Support ^b	Without Edge Support	Spacing of Supports Center-to-Center (Inches)								
				12	16	20	24	32	40	48	60	
16 o.c.	13/32, 3/4, 23/32	24	24	135	100	65	40					
20 o.c.	13/32, 3/4, 3/4	32	32	165	120	100	60	30				
24 o.c.	11/16, 23/32, 3/4	40	36	210	155	130	100	50	30			
48 o.c.	1 1/4	60	48	—	—	—	375	205	100	65	40	

NOTE a. The allowable spans were determined using a dead load of 10 psf. If the dead load exceeds 10 psf then the live load should be reduced accordingly.

NOTE b. Tongue-and-groove edges, panel edge clips (one between each support, except two between supports 48 inches on center), lumber blocking, or other. Only lumber blocking will satisfy blocked diaphragm requirements of Table No. IV.

NOTE c. Twenty-four inches for 3/8-inch panels.

NOTE d. May be used over framing spaced 24 inches on center for floors where 1 inch of approved gypsum concrete or 1 1/2 inches of cellular or lightweight concrete is applied over the panels.

NOTE e. May be used over framing of 24 inches on center where 23/32-inch wood strip flooring is installed at right angles to joist.

TABLE NO. VII - RECOMMENDED UNIFORM LOADS (psf) FOR NONVENEER RATED SHEATHING WITH LONG DIMENSION PARALLEL TO SUPPORTS

THICKNESS (In.)	SPAN RATING	MAXIMUM SPAN	NUMBER AND LENGTH OF SPANS					
			4 @ 12"		3 @ 16"		2 @ 24"	
			LIVE LOAD	TOTAL LOAD	LIVE LOAD	TOTAL LOAD	LIVE LOAD	TOTAL LOAD
7/16	24/0 24/16	16	115	135	40	50		
13/32, 1/2, 9/16	32/16	24 ^(a)	185	245	60	85	25	30
3/4	40/20	24			135	175	50	65

(a) Solid blocking recommended.

TABLE NO. VIII — MINIMUM APA RATED SHEATHING PLYWOOD REQUIREMENTS FOR WOOD FOUNDATION CONSTRUCTION
(30 pcf Equivalent-fluid Density Soil Pressure)

HEIGHT OF FILL (Inches)	STUD SPACING (Inches)	FACE GRAIN ACROSS STUDS ¹			Face Grain Parallel to Studs		
		Grade ²	Minimum Thickness ¹	Span Rating	Grade ²	Minimum Thickness ^{1,4}	SPAN RATING
24	12	B	$1\frac{1}{2}$ "	32/16	A B	$1\frac{1}{2}$ " $1\frac{1}{2}$ " ³	32/16 32/16
	16	B	$1\frac{1}{2}$ "	32/16	A B	$1\frac{1}{2}$ " ³ $1\frac{1}{2}$ " ³ (4-ply)	32/16 40/20
36	12	B	$1\frac{1}{2}$ "	32/16	A B B	$1\frac{1}{2}$ " $1\frac{1}{2}$ " ³ (4-ply) $1\frac{1}{2}$ " ³ (4-ply)	32/16 32/16 40/20
	16	B	$1\frac{1}{2}$ " ³	32/16	A B	$1\frac{1}{2}$ " $2\frac{1}{2}$ "	40/20 48/24
48	12	B	$1\frac{1}{2}$ "	32/16	A B	$1\frac{1}{2}$ " ³ $1\frac{1}{2}$ " ³ (4-ply)	32/16 40/20
	16	B	$1\frac{1}{2}$ "	40/20	A A	$1\frac{1}{2}$ " ³ $2\frac{1}{2}$ "	40/20 48/24
60	12	B	$1\frac{1}{2}$ "	32/16	A B B	$1\frac{1}{2}$ " $1\frac{1}{2}$ " ³ (5-ply) $2\frac{1}{2}$ "	40/20 40/20 48/24
	16	B	$1\frac{1}{2}$ " ³	40/20	A	$2\frac{1}{2}$ " ³	48/24
72	12	B	$1\frac{1}{2}$ " ³	32/16	A B	$1\frac{1}{2}$ " $2\frac{1}{2}$ " ³	40/20 48/24
	16	B	$2\frac{1}{2}$ " ³	48/24	—	—	—
86	12	B	$1\frac{1}{2}$ "	40/20	A A	$1\frac{1}{2}$ " ³ $2\frac{1}{2}$ "	40/20 48/24
	16	B	$2\frac{1}{2}$ " ³	48/24	—	—	—

¹Minimum thickness $1\frac{1}{2}$ inch, except crawl space sheathing may be $\frac{3}{4}$ inch for face grain across studs 16 inches on center and maximum 2-foot differential of backfill.

²Minimum 2-inch blocking between studs required at all horizontal panel joints more than 4 feet below adjacent ground level (also where noted in construction details).

Minimum all-veneer plywood grades are:

A. APA STRUCTURAL I RATED SHEATHING Exposure 1.

B. APA RATED SHEATHING Exposure 1 marked PS 1-83.

⁴When face grain is parallel to studs, all-veneer plywood panels of the required thickness grade and span rating may be of any construction permitted, except as noted in the table for minimum number of plies required.

For this fill height, thickness and grade combination, panels which are continuous over less than three spans require blocking 16 inches above the bottom plate. Offset adjacent blocks and fasten through studs with two 16d corrosion-resistant nails at each end.

APPENDIX 8

SAMPLE PROMOTIONAL LITERATURE



WAFERBOARD

...the mark of quality on every sheet of waferboard

When you see The Waferboard Association stamp on a sheet of waferboard, you know you have a product manufactured to the highest standards of quality, recognized by ICBO, SBCCI and BOCA.

INDEPENDENT TESTING Certification testing for member mills of The Waferboard Association is conducted by TECO Products and Testing Corporation, a totally independent body located in Eugene, Oregon and Washington, D.C. You know their findings are objective, professional, accurate – and trustworthy.

WAFERBOARD SPECIALISTS The Waferboard Association concentrates exclusively on waferboard panels. TWA members are specialists in the engineering and manufacture of waferboard. Independently and through the Association, they work constantly to improve their products and expand on the uses of waferboard in modern construction.

QUALITY MILLS The Waferboard Association comprises leading North American waferboard mills, names you can trust for consistent quality.

These are:

Grant Waferboard
Great Lakes Forest Products
MacMillan Bloedel
Normick Perron

Panofor
Waferboard Corp.
Weldwood

These waferboard mills are backed by the expertise in resin technology, engineering and distribution strengths of the Associate and Affiliate Members of The Association:

Bakelite Thermosets	N.G.M. International
Georgia Pacific Chemical Division	Northwood Mills
Reichhold	



THE
WAFERBOARD ASSOCIATION

For further information, write:
The Waferboard Association
P.O. Box 724533
Atlanta, Georgia 30339

Circle No. 390 on inquiry card

"Waferboard eliminates squeaky floors."

"The big advantage of waferboard is there's no delamination."

"We use a premium board – waferboard single layer flooring."



WAFTERBOARD

BUILD MORE QUALITY

ENGINEERED FOR STRENGTH AND HIGH PERFORMANCE

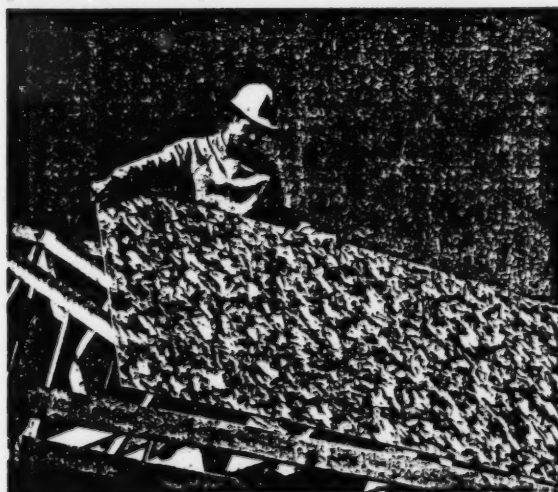
The secret of TWA waferboard's performance – and the reason for its success in meeting building code requirements – is the way it's manufactured. Waferboard is made of precision-cut wafers of selected hardwood combined with waterproof phenolic resins, formed into mats and bonded under heat and pressure.

The result: one of the most versatile of modern construction panels. It's ideal for single-layer floors, subfloors, and roof and wall sheathing in all residential construction.

It's great too for light commercial buildings and for farm structures. Renovators also recommend and use waferboard for many applications.

ANSI PRODUCT-RATED PANELS

TWA members also manufacture waferboard to the requirements of The American National Standards Institute – the traditional waferboard, recognised in all the major modern building codes, that builders have relied on for years. Now, for the convenience of builders, dealers and inspectors, the new TWA ANSI stamp shows the codes' recognised uses and spans on the surface of each panel. So you can choose TWA performance-rated or product-rated panels to meet your needs for the job.



TWA waferboard is easily workable, with excellent nail holding properties in one all-purpose exterior grade.



TWA waferboard is strong, durable, rigid, with excellent racking resistance.

COUNT ON CONSISTENT SUPPLIES OF WAFTERBOARD

More and more member mills of The Waferboard Association are now producing performance-rated waferboard. Wherever you're located, you can count on a ready supply of performance rated or ANSI product-rated panels – in a variety of thicknesses to meet virtually every construction need.

**BUY AND BUILD
IN FULL CONFIDENCE
WITH**



RATED WAFTERBOARD

*Savings calculated on the basis of a 1,400 sq. ft. home; materials priced according to October 19, 1985 Random Lengths Chicago for $\frac{3}{4}$ " Waferboard and $\frac{1}{2}$ " CDX (roof and walls) and $\frac{3}{4}$ " T & G Waferboard and $\frac{1}{2}$ " T & G plywood single-layer floor. Savings may vary from region to region.

CONSISTENTLY HIGH-QUALITY PANELS



WAFERBOARD
RATED

RATED

BUY MORE ECONOMICALLY

This stamp represents one of the most important recent developments in the North American home building industry. It is The Waferboard Association (TWA) Performance Rating, and you will now find it on waferboard construction panels manufactured by members of The Association.

WHAT DOES THIS PERFORMANCE RATING MEAN TO YOU, THE BUILDER?

Many things. It means you can now specify, buy and use waferboard knowing exactly how it will perform in any given application. For each waferboard panel you know the span rating for roof sheathing or flooring, panel thickness and exposure durability.

And most important, you have the assurance that comes with the National Evaluation Report number (NER) on every sheet; the knowledge that TWA performance-rated waferboard meets the rigid standards demanded by ICBO, SBCCI and BOCA.

Indeed, you can now specify TWA rated waferboard with all the confidence you have in other rated panels...and enjoy the many other benefits TWA waferboard offers.



**WAFERBOARD
RATED
SINGLE-LAYER
FLOOR**

24 OC 3/4"

EXPOSURE 1

NER-322

The TWA waferboard stamp gives you span limits for specific applications. For example this 24 o.c. refers to the maximum recommended spacing of supports as a combined subfloor-underlayment.



TWA waferboard gives a solid feeling underfoot without problems of delamination, voids or splits.

**SAVE
\$140 PLUS
PER HOME**

A QUALITY PANEL THAT SAVES YOU MONEY

Waferboard's consistent quality solves many of your on-the-job problems. You don't have to worry about delamination... floors feel solid, stay firm, don't squeak. There are no voids, knot holes or splits with waferboard. So you cut out call backs and save work and waste.

You save when you buy TWA rated waferboard, too. American home builders have found that switching to TWA waferboard can save them hundreds of dollars per home. One builder saved close to \$20,000 on a 64-home development, others have saved more than \$250 per home.

RATED WAFERBOARD FOR ECONOMICAL

ATTENTION: PROFIT-CONSCIOUS BUILDERS...

BOARD
FOR
BUILDING
QUALITY



NATIONAL BOARD FOR BUILDING QUALITY

WAFFERBOARD

VS

PLYWOOD

WAFFERBOARD

- Meets major U.S. Building Codes.
- Solid, uniform face. No knotholes or surface splits.
- Solid throughout. No core voids.
- No delamination.
- Equally strong and stiff in both directions. Can be applied parallel to or across supports.
- One all purpose exterior grade.
- Easily workable. Excellent nailing properties.
- COST SAVINGS

PLYWOOD

- Meets major U.S. Building Codes.
- Surface voids. Knotholes, splits.
- Core voids.
- May delaminate.
- Unequal strength; weaker across the grain.
- Must select from numerous grades.
- Easily workable.

**Solid reasons to
switch to Waferboard**

The dependable, cost-reducing structural panel



THE
WAFFERBOARD ASSOCIATION

WAFTERBOARD

Proven product benefits and cost savings.

The typical cost savings per moderate sized home shown below are based on the purchase price of materials only; you can expect further savings from waste reductions.



WAFTERBOARD

SUB-FLOOR

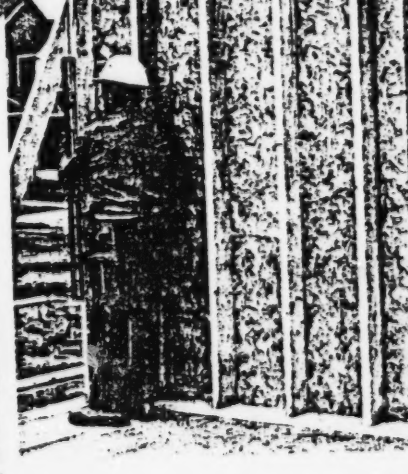
- solid feeling underfoot
- no core voids
- uniform surface
- eliminates squeaking floors and nail popping
- flat; warp resistant

COST SAVING \$99.

ROOF SHEATHING



WALL SHEATHING



ROOFS

- can be applied parallel to or across supports
- cut-offs usable for soffits, gables

COST SAVING \$80.

WALLS

- racking resistance equal in both directions

COST SAVING \$46.

*Cost Reductions

The Waferboard savings are calculated on the basis of a 28' x 50' one-storey home with 1,400 sq. ft. subflooring, 1,750 sq. ft. roofing, and 1,000 sq. ft. walls.

Materials priced according to Aug. 20, 1982 Random Lengths

Chicago for 7/16" Waferboard and 1/2" CDX (roof and walls) and 5/8" T & G Waferboard and 5/8" T & G plywood sub-floor.

Savings may vary from region to region. Check with your building supply dealer for prices in your area.

TOTAL SAVINGS WITH WAFTERBOARD

\$225.

VS

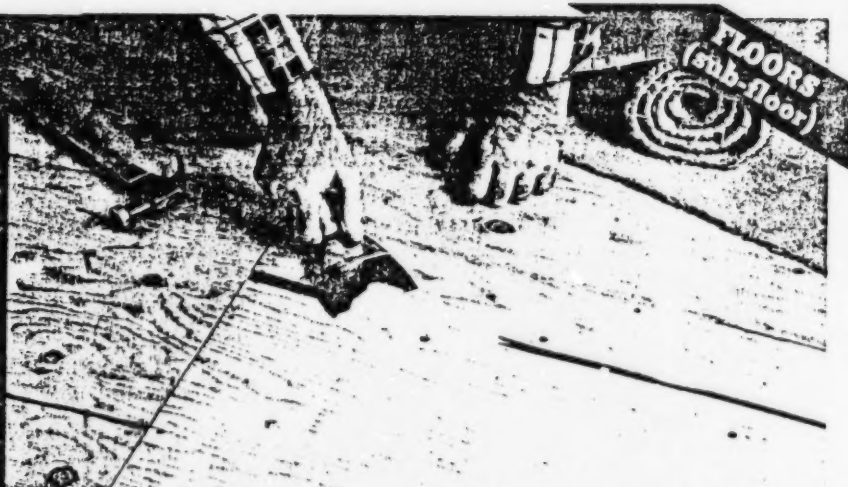
PLYWOOD

Solid reasons to switch to Waferboard.

PLYWOOD

SUB-FLOOR

- core voids
- surface voids, knotholes, splits
- may warp
- may delaminate



ROOFS

- install lengthwise across supports
- cut-offs often wasted



WALLS

- racking resistance not equal across grain



Solid reasons to switch to Waferboard



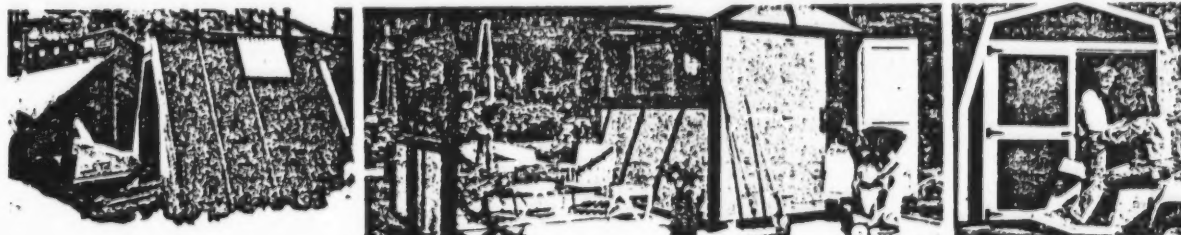
THE
WAFERBOARD ASSOCIATION

_____ and the Winner is _____

WAFERBOARD

The structural panel of the future that is already taking over from plywood in many parts of the country!

- **Structurally engineered:** Waferboard is an exterior grade engineered structural panelboard made from precision cut wafers, coated with waterproof phenolic resin and bonded under heat and pressure. Waferboard is manufactured in accordance with American National Standard ANSI A208.1-1979 Grade 2-M-W, is certified by TECO, and specified in the Basic, the One and Two Family Dwelling, and the Standard Building Codes. Waferboards are also listed by HUD/FHA and ICBO.
- **Cost efficient:** Savings in purchase price and waste reductions can amount to several hundreds of dollars per average size home.
- **Strong, rack resistant:** Waferboard is strong and durable, and has been used with confidence by professional builders since 1965. It adds rigidity to wood frame construction; provides all necessary corner bracing.
- **Attractive, indoors and outdoors:** Waferboard is weather resistant and can be used indoors and out. Its uniform random wafer pattern makes it an attractive easy-to-finish surface.
- **Applications unlimited:** The ideal structural panelboard for subfloors, roofs and side walls, Waferboard is also excellent for fencing, exterior cladding of farm structures, cottages, tool and garden sheds, and many other purposes.
- **Dependable supply:** Production capacity of the mills represented by The Waferboard Association guarantees that builders' long-term demand for structural waferboard will be met. The strategic location of our mills ensures a continuing supply to all regions of the country.
- **Full range of thicknesses:** Waferboard panels, all in one versatile grade, are available in 1/4", 5/16", 3/8", 7/16", 1/2", 5/8" and 3/4" thicknesses.



Join the trend of American builders, switch to Waferboard now!

Yes, I'd like to reduce my building costs with Waferboard.
Please send your brochure "Waferboard In Residential Construction"

NAME _____

FIRM _____

ADDRESS _____

CITY _____

STATE _____

ZIP _____

"The Waferboard Association", P.O. Box 111, Deer Park, N.Y. 11729

Circle no. 30 on inquiry card



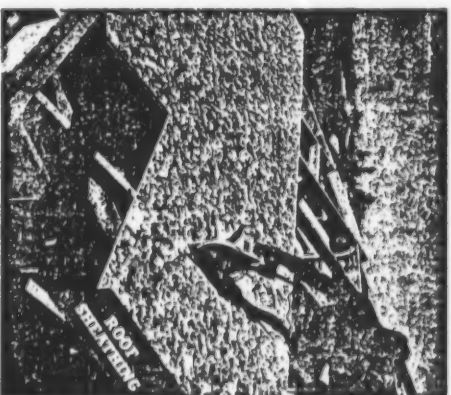
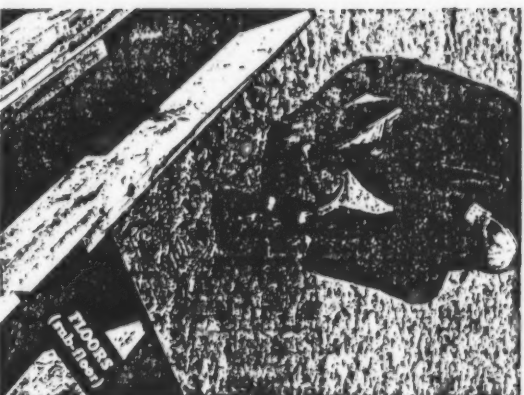
THE
WAFERBOARD ASSOCIATION

WATERBOARD!

THE HIGH PERFORMANCE STRUCTURAL PANEL

QUALITY ENGINEERING FOR REMARKABLE WATERBOARD STRENGTH

Waterboard is engineered for superior performance and strength. It's made of precision-cut hardwood wafers bonded together under extreme heat and pressure with waterproof resin. The result is a panel of exceptional strength, stiffness and rigidity in both dimensions. It's ideal for single-layer floors, sub-floors, roof sheathing, wall sheathing and many other applications. So waterboard does everything other sheathing panels can do — in many cases better — and for less money.



THE QUALITY CHOICE FOR ROOF AND WALL SHEATHING AND FLOORING

There are no splits, knot holes or core voids with waterboard: surfaces are smooth and uniform. Floors feel solid, stay firm, don't squeak. You cut down waste and expensive callbacks. And waterboard's stiffness and strength assures solid roofs, and walls with excellent racking resistance.

What's more, waterboard is beautifully workable; it saws cleanly without splits and rough edges; it has good nail-holding and stapling properties. Builders who have switched to waterboard report satisfaction among home-buyers with the quality and solid feel of waterboard underfoot.

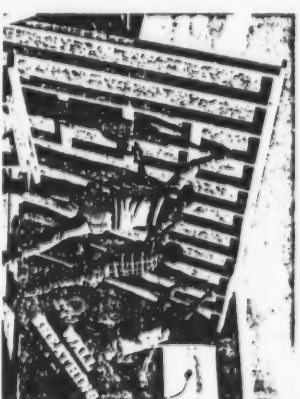
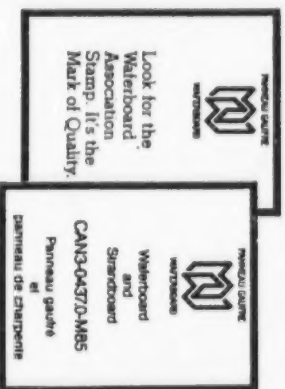
BUILD WITH WAFERBOARD AND GIVE YOUR

QUALITY PLUS

THAT CUTS COSTS WITHOUT CUTTING CORNERS

WAFERBOARD MEETS CANADIAN BUILDING CODES

You can switch to waterboard made by members of The Waferboard Association (TWA) with absolute confidence. It meets the National Building Code and every provincial building code in Canada. Waterboard made by Association members is made to rigid quality standards so that panels manufactured by member mills are completely compatible. The Waferboard Association stamp on every panel assures quality engineering and gives you panel thickness and span limits for specific applications.



PERFORMANCE PROVEN FOR OVER 20 YEARS

For over 20 years, builders across North America have seen for themselves the advantages of waterboard panels. In single-family homes, condominiums, row houses and light commercial buildings waterboard has proven itself the high-tech alternative to plywood. And you can count on members of The Association for dependable supply. Member mills of The Association have invested hundreds of millions of dollars to give you quality panels when you need them, wherever you're located.

THE BIG "PLUS" WITH WAFERBOARD IS ECONOMY!

Across the continent, builder after builder is reporting savings of hundreds of dollars per home by switching to TWA waterboard. Waterboard can save you over \$600* per home versus plywood. That's because waterboard makes better use of the forest. Mills are highly automated and more equipment and

labour efficient than plywood, and these savings are passed on to the builder. And you'll have less waste on the job and fewer callbacks too!

*Savings calculated on the basis of a 1,000 sq. ft. house, materials priced October 17, 1986 (Toronto list 7/16" waterboard and 3/4" plywood, and 1 1/2" waterboard and 3/4" plywood). Actual savings may vary from region to region.

HOMES THIS PROFITABLE "QUALITY PLUS"

WATERBOARD RATED BUY MORE ECONOMICALLY

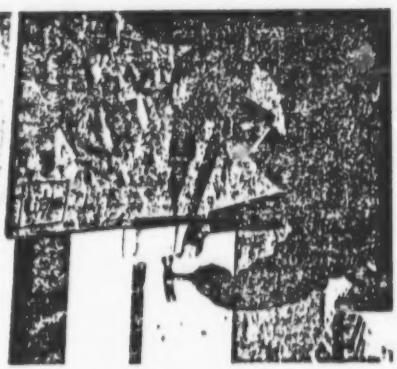
WATERBOARD BUILD MORE QUALITY

This stamp represents one of the most important recent developments in the North American home building industry. It is The Waterboard Association (TWA) Performance Rating, and you will now find it on waterboard construction panels manufactured by members of The Association.

WHAT DOES THIS PERFORMANCE RATING MEAN TO YOU, THE BUILDER?

Many things. It means you can now specify, buy and use waterboard knowing exactly how it will perform in any given application. For each waterboard panel you know the spans rating for roof sheathing or flooring, panel thickness and exposure durability.

And most important, you have the assurance that comes with the National Evaluation Report number (NER) on every sheet. The knowledge that TWA (NER) has tested the product to the highest standards demanded by ICCBO, SBCCI and BOCA. Indeed, you can now specify TWA rated waterboard with all the confidence you have in other rated panels... and enjoy the many other benefits TWA waterboard offers.



TWA waterboard grows a solid building without problems of delamination, voids or splits.

SAVE PLUS \$140 PER HOME

A QUALITY PANEL THAT SAVES YOU MONEY

Waterboard's consistent quality solves many of your on-the-job problems. You don't have to worry about delamination... floors feel solid, dry firm, don't squeak. There are no voids, hot holes or splits with waterboard. So you cut out call backs and save work and waste.

You save when you buy TWA rated waterboard, too. American home builders have found that switching to TWA waterboard can save them hundreds of dollars per house. One builder saved close to \$20,000 on a 64 house development; others have saved more than \$250 per house.

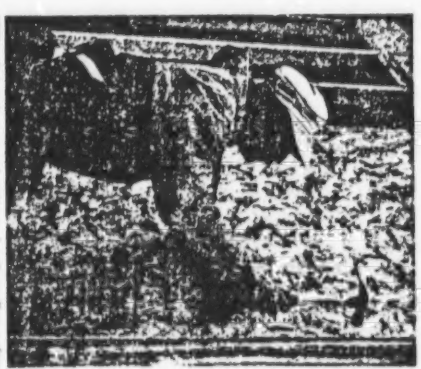
ENGINEERED FOR STRENGTH AND HIGH PERFORMANCE

The secret of TWA waterboard's performance... and the reason for its success in meeting building code requirements... is the way it's manufactured. Waterboard is made of precision-cut wafers of selected hardwood combined with waterproof phenolic resins, formed into mats and bonded under heat and pressure.

The result: one of the most versatile of modern construction panels. Its ideal for single-layer floors, subfloors, and roof and wall sheathing in all residential construction. It's great too for light commercial buildings and for farm structures. Renovators also recommend and use waterboard for many applications.

ANSI PRODUCT-RATED PANELS

TWA members also manufacture waterboard to the requirements of The American National Standards Institute - the traditional waterboard, recognized in all the major modern building codes, that builders have relied on for years. Now, for the convenience of builders, dealers and inspectors, the new TWA ANSI stamp shows the codes recognized uses and spans on the surface of each panel. So you can choose TWA performance-rated or product-rated panels to meet your needs for the job.



TWA waterboard is strong, durable, rigid, with excellent finishing properties.

COUNT ON CONSISTENT SUPPLIES OF WATERBOARD

More and more member mills of The Waterboard Association are now producing performance-rated waterboard. Wherever you're located, you'll find a ready supply of performance-rated or ANSI product-rated panels... in a variety of thicknesses to meet virtually every construction need.

BUY AND BUILD IN FULL CONFIDENCE WITH



RATED WATERBOARD

*This logo is located on the face of a 1/2" x 1/2" x 1/2" waterboard according to October 10, 1987 Building Length Change No. 1, Waterboard and ICCBO (and other) and 1/2" x 1/2" x 1/2" Waterboard. It provides complete information about the product and its use.



WATERBOARD

RATED SINGLE-LAYER FLOOR

24 OC 3/4"

EXPOSURE 1

NER-322

The TWA waterboard stamp gives you vital hints for specific applications. For example, the stamp on the left indicates a performance rating of exposure 1, combined with a 24 OC 3/4" span rating.

RATED WATERBOARD FOR ECONOMICAL

CONSISTENTLY HIGH-QUALITY PANELS

The Smart Man's Plywood.

L. P. Waterwood is an interior/exterior building panel that does plywood jobs better than plywood. And costs less.

It's made from large, thin waters of quality woods bonded together under extreme heat and pressure with a waterproof phenolic resin. The resulting panel is smoother, more uniform, and easier to work with than plywood. So when you build your project with L. P. Waterwood, it comes out an even greater success. And you save money.

No wonder it's the smart man's plywood.

Use L. P. Waterwood for All Plywood Jobs.

One economical panel of L. P. Waterwood is the perfect replacement for any of 14 different surfaces, grades, and glue lines of plywood.

Use L. P. Waterwood anywhere you'd use plywood, indoors or out. Build a garage, storage shed, or playhouse with it. Or use it to make bookcases, cabinets, and planters. For roofing jobs, get better flooring with L. P. Waterwood. Its got a textured anti-skid surface.

And for flooring use L. P. Waterwood tongue and groove. Its approved for Sundeck floor construction.

by the American Plywood Association.

Whichever the job, if plywood has been the answer, L. P. Waterwood is the better solution. There's no limit to what you can do with it.

L. P. Waterwood comes in all thicknesses from $\frac{1}{8}$ " to $\frac{3}{4}$ ".

L. P. Waterwood is Easy to Work With.

Working with L. P. Waterwood is just like working with plywood. Only it's easier because L. P. Waterwood is actually more like solid wood than plywood. It's a solid panel with none of the imperfections you find in plywood. There are no core voids, splits, knots, or patches. And because L. P. Waterwood is made in oversized presses, it also has a higher density at the edge. So it nails better. Exceptionally strong in all directions.

Sawing.

Waterwood can be used more efficiently than plywood because L. P. Waterwood's random, grainless water pattern makes matching the grain unnecessary. L. P. Waterwood can be cut in any direction, so planning cuts is easier and you get more usable wood per panel.

Crescent saws and blades cut L. P. Waterwood

best. The finer toothed blades with the least set give the smoothest cleanest cuts. When using a sabre or circular saw, cut with the side you want to use facing away from you. With all other saws, keep the side you want to use facing you.

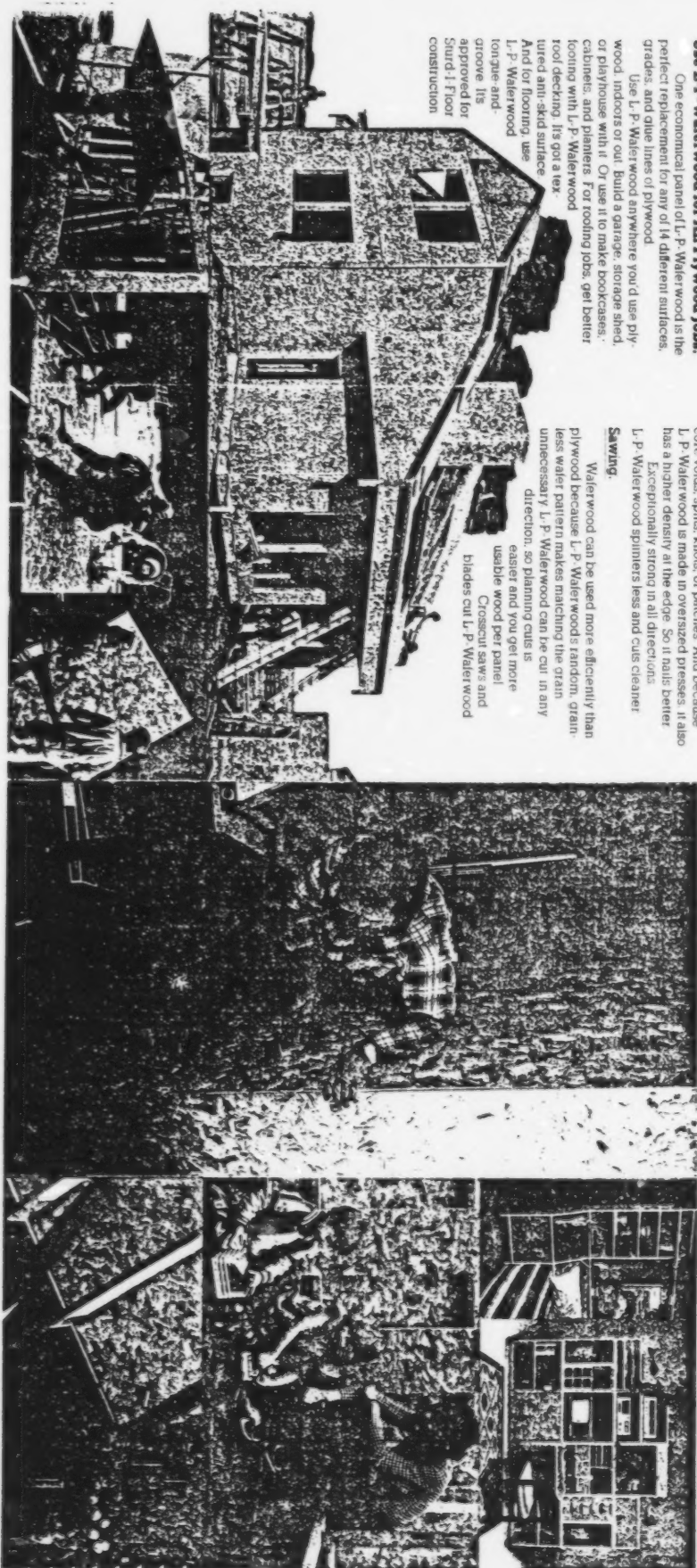
Nailing and Fastening.

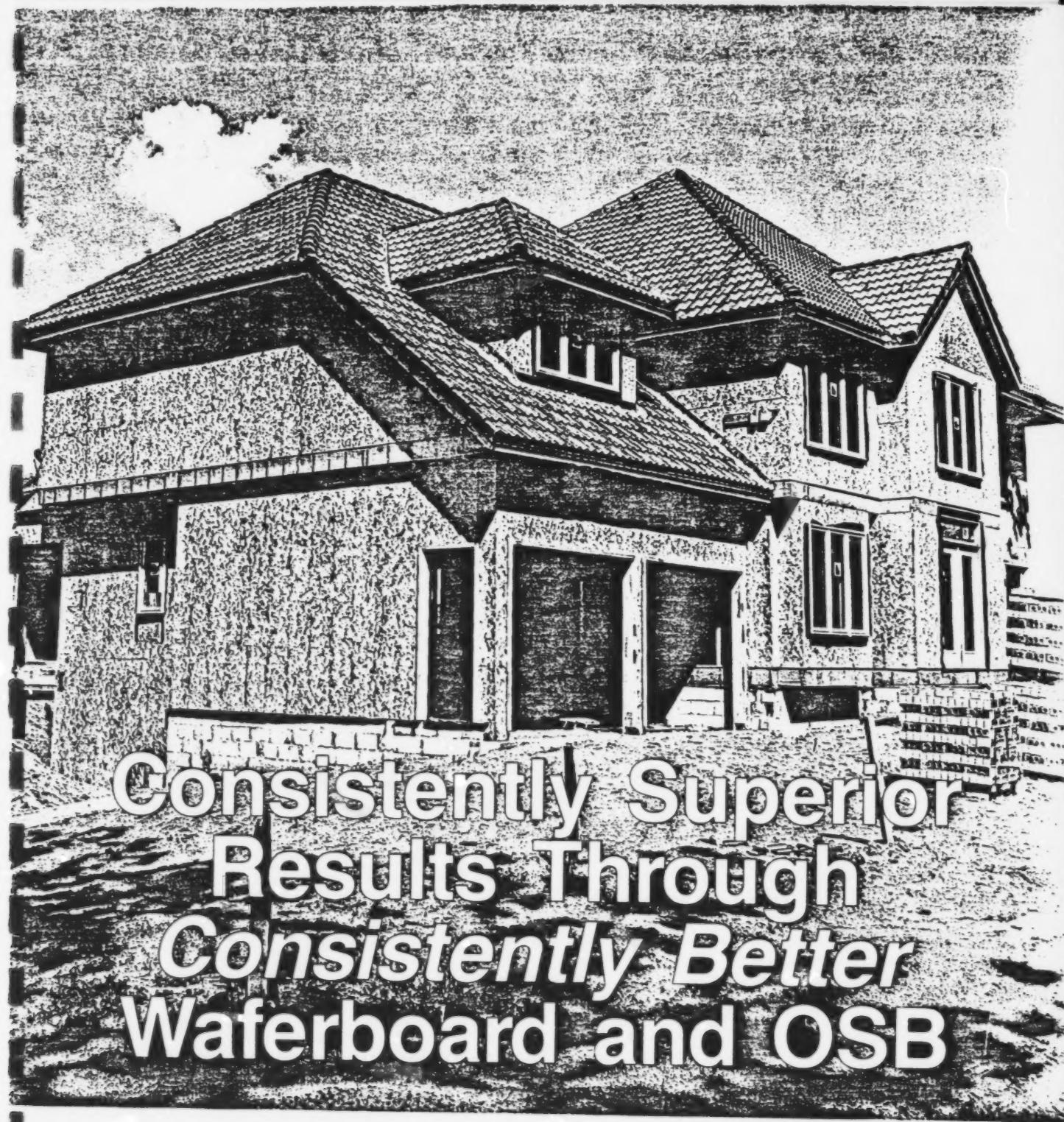
Fasten L. P. Waterwood with nails, screws, staples, or glue just as you would any other panel. You can nail within $\frac{1}{8}$ " of the edge with no risk of splitting. Use common nails where strength is important. Use finish nails for appearance.

When nailing or screwing into an edge, use short, thin nails or screws with pre-drilled pilot holes.

Shaping and Sanding.

L. P. Waterwood needs no surface finishing for most home projects. If desired, it can be planed and sanded. Spindle bits may be used to bevel or round an edge or to groove the surface. Straight flutings or rabbeted edges work well. Sharp cuts are acceptable but leave a rounded edge wherever the router bit crosses individual waters. A saw or dado blade works better.





Consistently Superior
Results Through
Consistently Better
Waferboard and OSB

FORPAN

Superior Forpan technology produces *Consistently Better* waferboard structural panels

Consistently Better Technology Makes Forpan a North American Leader

Added to the Forpan line of products in 1982, Forpan Waferboard today ranks as one of North America's major suppliers of high quality waferboard.

The secret of this success has been Forpan's determination to maintain technological leadership in the industry. Its plant is highly automated and backed by superior human resources from management and marketing to "on the line" workers.

So the buyer of Forpan waferboard – professional builder or do-it-yourselfer – is assured of the very best product that modern technology and human skill can produce.

Consistently Better Engineered Quality

Forpan's waferboard manufacture reflects engineering "know-how" learned in its particleboard panel plant.

The continuous belt-transfer press without caul plates ensures uniform surfaces that are preferred by builders for single-layer floors. Fine engineering backed by strict quality control gives Forpan the quality edge – T&G edges that fit easily together, screened surfaces that provide superior roof traction.

It's these consistent quality advantages that have led to a strong builder preference for Forpan waferboard over other waferboard panels.

Consistently Better Performance Meets All Major Building Codes

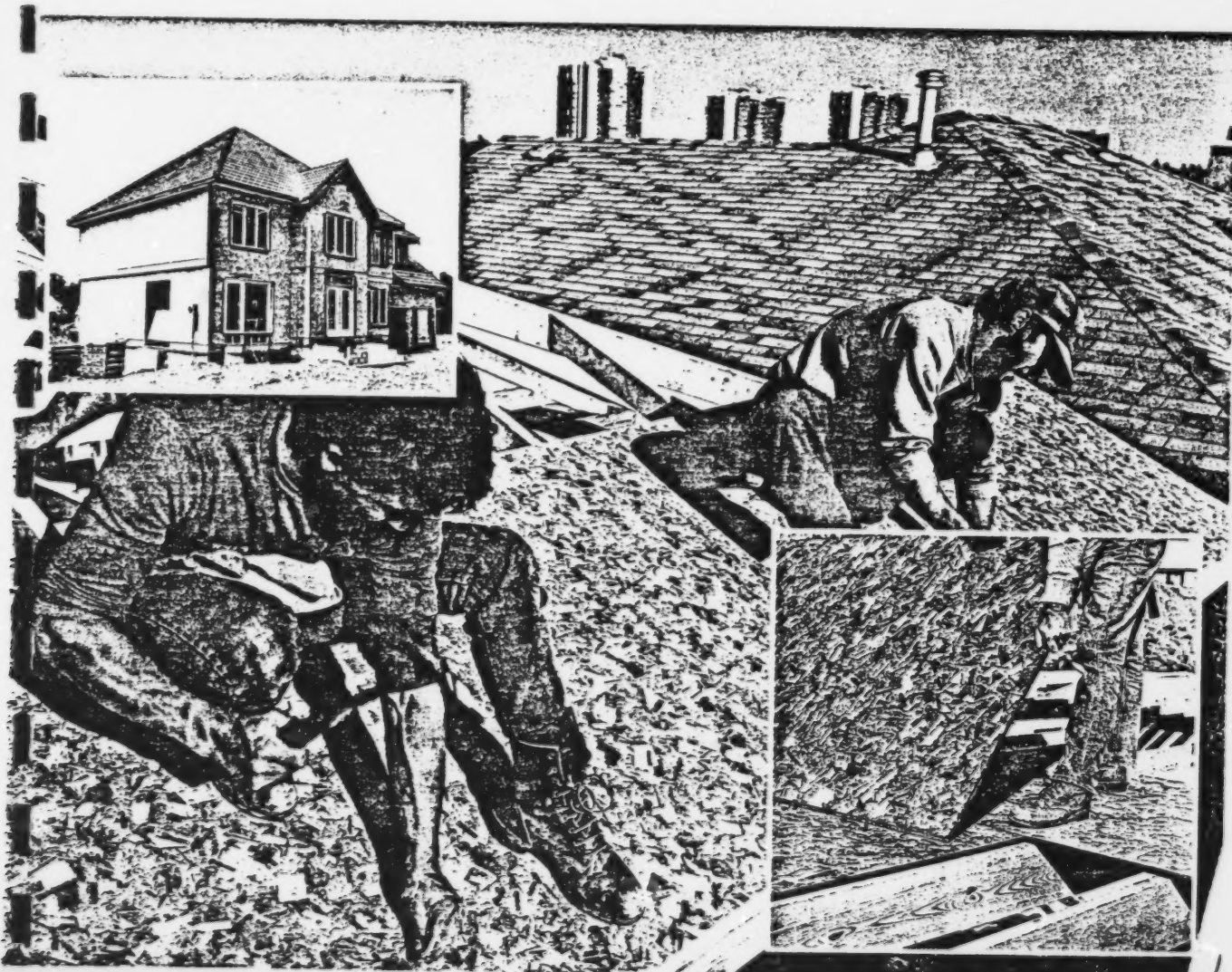
Builders across North America can use Forpan waferboard with complete confidence in its ability to meet the most stringent building codes in their areas. Forpan waferboard meets American National Standard ANSI A208.1-1979 Grade 2-M-W, is certified by TECO and recognized by major

U.S. code agencies CABO (BOCA, SBCCI and ICBO). Forpan panels also conform to HUD/FHA Release No. 1184. In Canada, Forpan meets the National Building Code and is approved by CMHC for use in residential housing under BMR 10371.

Consistently Better Supplies and Deliveries

The Forpan Waferboard mill is ideally located for the major markets of Canada and the eastern United States. Reinforced by a wide network of distributors in both countries, shipping is fast, dependable and economical.

Further, the mill is close to major stands of quality aspen, the ideal hardwood for making waferboard. So raw materials pose no problems in meeting customer's long-term needs.



Forpan Introduces OSB Structural Panel, for Superior Strength and Performance

Forpan OSB Provides Superior Span Ratings

Forpan's new Oriented Strand Board (OSB) represents a totally new approach in the engineering of modern structural panels. It is manufactured with 3" long strands of selected hardwood with the outer layers oriented to provide maximum strength and rigidity.

In turn, these layers are bonded to the inner core under high heat and pressure, using resins especially developed for the purpose. The result is a panel with superior span ratings - 24/16 for 7/16" thickness, 20" oc for 5/8" T&G and 24" oc for 3/4" T&G flooring.

Forpan OSB Saves Builders Precious Time and Money

With its superior strength and improved span ratings, Forpan OSB offers important cost economies to the builder.

To start, no H-clips are required for edge support (where building codes permit). That means valuable savings in materials, time and labour.

But that's only the beginning. Forpan OSB goes to the market *priced significantly below plywood* - so the builder can actually save hundreds of dollars per home by substituting Forpan OSB for traditional plywood roof sheathing, wall sheathing and flooring.

Furthermore, Forpan OSB has no core voids or knotholes; there's no splitting, no delamination. That means important savings on materials and callbacks.

Distinctive Green Edge Seal Identifies Full Range of Sizes

You can identify Forpan OSB by the distinctive green edge seal. It protects the panels from moisture both in storage and on the job site. And just as important, it tells you the panel is made by Forpan - your assurance of the ultimate in quality.

You can specify Forpan OSB in a full range of thicknesses and span ratings for roof and wall sheathing and flooring.

Span Ratings

 WAFFERBOARD RATED SINGLE-LAYER FLOOR 24 OC 3/4" EXPOSURE 1 NER-322	 WAFFERBOARD RATED SHEATHING 24/16 7/16" EXPOSURE 1 NER-322
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Consistently Better Forpan Waferboard and OSB Panels Meet All the Modern Builder's Needs

The most quality-conscious lumber wholesaler and the most demanding residential builder – both can rely on Forpan products to measure up to their highest standards. See for yourself why customers all across America agree that Forpan products are *consistently better*, shipment after shipment and panel after panel.

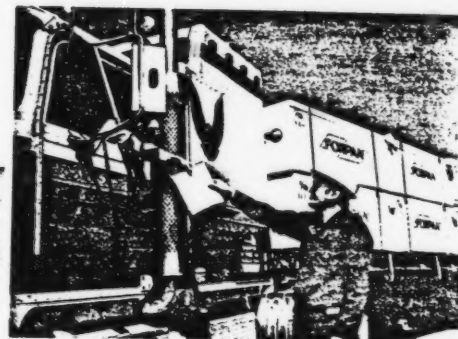
Technical Specifications

Code Approvals

Forpan roof and wall sheathing and T&G flooring panels meet performance standards for Grade 2-M-W under American National Standard **ANSI A208.1-79**.

Forpan waferboard roof and wall sheathing and T&G flooring panels are accepted by the Council of American Building Officials (**CABO**) – National Evaluation Reports Number 315. (**NER 315**). Forpan OSB panels are accepted by **CABO** (**NER 322**). Forpan panels conform to **HUD/FHA** Materials Release No. 1184. Panels are **TECO** tested. The Waferboard Association stamp certifies that Forpan panels meet all performance standards of **BOCA, ICBO and SBCCI**.

In Canada, Forpan panels meet the requirements of Grade 0-2 in **CSA Standard CAN3-0437.0-1985** "Waferboard and Strandboard".



Comparison of Recommended Uniform Live Loads For Roof Decking

Panel Type	Panel Thickness	Allowable Live Load (psf)				
		Support Spacing Center to Center (inches)				
		12"	16"	20"	24"	32"
Forpan OSB	7/16"	135	100	75	40	
Plywood	3/8"	90	65	55	30	
Forpan Waferboard	7/16"				30	

Product Range

	Forpan OSB	Forpan Waferboard	T&G Edge	Safety Traction Surface	Edge Seal
1/4"		X			
5/16"		X			
3/8"	X	X		X	
7/16"	X	X		X	X*
1/2"	X	X			
5/8"	X	X	X		X
3/4"	X	X	X		X
7/8"		X	X		X
1"		X			

* OSB only

Comparative Spans

Sheathing Thickness	Forpan OSB	Plywood	Forpan Waferboard
3/8" span index ¹	24/0	24/0	16/0
max. roof span/no clips ²	20	20	—
7/16" span index ¹	24/16	—	24/0
max. roof span/no clips ²	24	—	16
5/8" T&G span index ¹	40/20	40/20	—
max. floor span ³	20	20	20*
3/4" T&G span index ¹	48/24	48/24	—
max. floor span ³	24	24	24**

1. Span Index. The left hand number is the maximum recommended spacing of roof framing, in inches, when the panel is used as roof sheathing with the long panel dimension across three or more supports. Use of reinforcing "H" clips is required on some applications to achieve total span length. The right hand number is the maximum span between joists when the panel is used for flooring applications.

2. Maximum distance between roof framing when the panel is used as roof sheathing without edge support/reinforcing clips.

3. Maximum Floor Span. This is the maximum recommended spacing of supports when the panel is used for sub-floors.

* 16" in single-layer floor systems.

** 20" in single-layer floor systems.



FORPAN INC.
SALES AND MARKETING
PLACE DU CANADA
1010, RUE DE LA GAUCHETIERE OUEST
BUREAU 1470, MONTREAL, QUEBEC
CANADA H3B 2N2
TELEPHONE (514) 393-1166

What Each New Home Start Means to Retail Sales

Lumber, building materials and hardware
used in the average 1,710 sq. ft. house

2,340 sq. ft. of 3 1/2-in. insulation plus
900 sq. ft. of 13 1/2-in. insulation in the roof

12,200 board ft. of lumber

7,025 sq. ft. of drywall

1,680 sq. ft. of flooring

1 1/2-ton heating unit

2 toilets

3 sinks

2 tubs or

1 tub and 1 shower

85 gal. of paint

302 lbs. of nails

12 windows

99 sq. ft. of glass

45 cu. ft. of dirt excavated

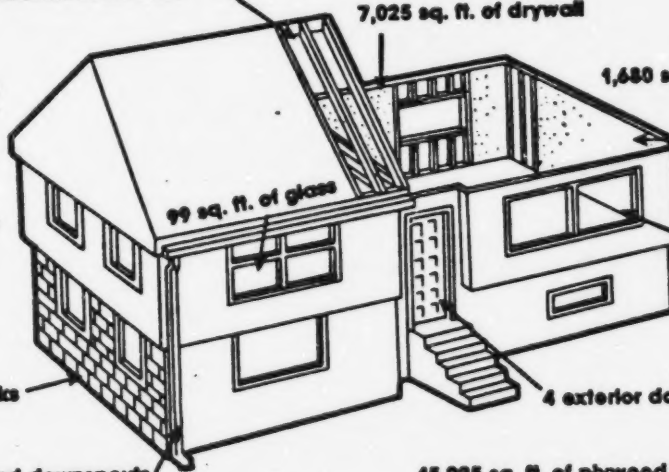
2,680 concrete blocks

4 exterior doors, 11 interior doors

230 sq. ft. of gutters and downspouts

15,025 sq. ft. of plywood in exterior walls, 453 sq. ft.
of plywood in floors, 2,030 sq. ft. of plywood in siding
and 2,040 sq. ft. of plywood in roofs.

Source: National Association of Home Builders



norbord oriented structural board

FACTS AND FIGURES

PERFORMANCE RATING

NORBORD OSB panels are engineered and designed to conform with the requirements of industry-wide Structural-Use Panel performance standards. To obtain FLOOR SPAN or SHEATHING SPAN certification, representative NORBORD OSB samples were subjected to a series of rigorous performance tests. Panels were tested under simulated conditions and loadings, that would be expected in service, to ensure that performance met criteria as specified in CABO NEB 133. Product specifications were then established as benchmark references for production. All certification testing is carried out by TECO, an independent testing agency.

APPROVALS

Use of NORBORD OSB is approved by the major code agencies through TECO's proprietary Council of American Building Officials (CABO) NEB Report 133. With CABO recognition, acceptance by Building Officials and Code Administrators (BOCA), the International Conference of Building Officials (ICBO) and Southern Building Code Congress International (SBCCI) is automatic.

Although this CABO approval is widely accepted, please note that it is the responsibility of the end-user to conform to current requirements of local building authorities.

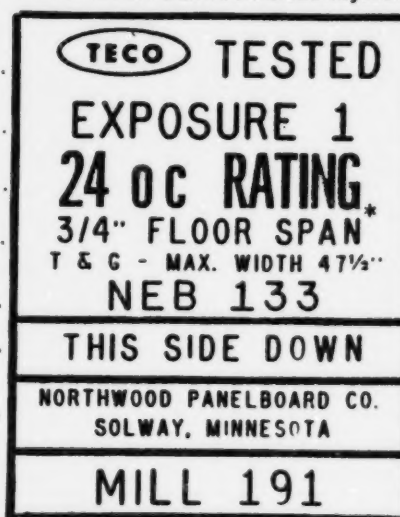
Square Edge Sheathing



SAMPLE GRADE STAMPS

.... Quality — TECO certified
 Durability Rating
 Span Rating
 .. Thickness, End-Use Category ..
 Performance Rating Procedures
 Approved by CABO
 Specific Use Information
 Made in U.S.A.

Tongue and Groove — Combination Subfloor/Underlayment



ALLOWABLE UNIFORM ROOF LIVE LOADS FOR NORBORD OSB SHEATHING SPAN PANELS WITH LONG DIMENSION PERPENDICULAR TO SUPPORTS¹

SPAN RATING	PANEL THICKNESS	MAXIMUM SPAN (Inches)		ALLOWABLE LIVE LOADS (psf)						
		WITH EDGE SUPPORT ²	WITHOUT EDGE SUPPORT	SPACING OF SUPPORTS CENTER-TO-CENTER (Inches)						
				12	16	20	24	32	40	48
24/0	3/8	24	20	90	65	55	30			
24/16	7/16	24	24	135	100	75	40			
32/16	1/2	32	28	135	100	75	55	30		
40/20	5/8	40	32	165	120	100	75	55	30	
48/24	3/4	48	36	210	155	130	100	65	50	35

¹ The allowable spans were determined using a dead load of 10 psf. If the dead load exceeds 10 psf then the live load should be reduced accordingly.

² Tongue-and-groove edges, panel edge clips (one between each support, except two between supports 48 inches on center), lumber blocking, or other.

ALLOWABLE UNIFORM FLOOR LOADS NORBORD T&G PANELS^{1,2,3}

PANEL SPAN RATING	PANEL THICKNESS (Inch)	MAXIMUM SPAN (Inches)	ALLOWABLE LOADS (Pounds per Square Foot)	
			MAXIMUM LIVE LOAD	MAXIMUM DEAD LOAD
20	5/8	20	85	25
24	3/4	24	85	25

¹ Panels are continuous over two or more spans and installed with the long panel direction perpendicular to supports.

² Uniform load deflection limitation: 1/360 of the span under 100 psf.

³ Edges must have tongue-and-groove joints or must be supported with blocking.

NORBORD PACKAGING

THICKNESS	EST. AVERAGE WT/MFT ²	PIECES/LIFT
1/4"	900 lbs	135
5/16"	1065 lbs	105
3/8"	1285 lbs	95
7/16"	1420 lbs	88
1/2"	1640 lbs	75
5/8"	2050 lbs	60
5/8" T&G	2050 lbs	60
3/4"	2355 lbs	50
3/4" T&G	2355 lbs	50



oriented structural board

INSTALLATION INSTRUCTIONS

- 1) Information relevant to certification, code approval, span ratings, durability and mill identification are included in the grade stamp applied to every panel where applicable.
- 2) As with any wood product, NORBORD OSB should be handled and stored to avoid excessive moisture pick-up or excessive dryness. Prior to application, acclimatization of NORBORD OSB to surroundings, for at least 24 hours, is recommended.
- 3) All rated NORBORD OSB has an EXPOSURE 1 durability rating. Although panels should not be directly exposed to the weather or moisture on a continuous or permanent basis, the EXPOSURE 1 rating on NORBORD OSB indicates that unprotected exposure during ordinary construction periods will not adversely affect the structural properties. Exposure to adverse moisture conditions could result in edge swelling. Sanding may be required prior to finish covering application.
- 4) NORBORD OSB used as roof or floor sheathing should be applied with stamped faces down.
- 5) Unless otherwise noted, all panels should be continuous over 2 or more spans with the long dimension perpendicular to supports, all end joints should be on supports and staggered, and all panels should be spaced 1/8" along all edges.
- 6) Nail spacing should be 6" on center along panel edges and 12" on center into intermediate supports, (10" on center into intermediate supports for floor sheathing). Nails should penetrate structural members a minimum of 1".
- 7) Adequate ventilation should be provided in unheated attics and crawl spaces. Net vent openings of at least 1/150th the attic or crawl space horizontal area are recommended. Attic ventilation should be divided equally between roof and soffits.

RECOMMENDED USE:

The following uses are approved by the major code agencies through the Council of American Building Officials (CABO) NEB report 133 (exceptions noted). Regional codes are subject to periodic changes and local codes can vary widely. It is the responsibility of the user to conform to current requirements of local building authorities.

Application	Structural-Use Category (TECO Grade)	NORBORD OSB Thickness (in.)	Maximum Support Spacing (in.)	Application and Nailing Notes
Combination Subfloor-Underlayment *†	FLOOR SPAN - Tongue and Groove	5/8 T and G 3/4 T and G	20 24	Apply panels perpendicular to supports. If T and G panels are not used panel edges must be adequately blocked. Butt panel edges in light contact. Fasten with 8d deformed shank nails or equivalent. Some edge sanding may be required if panels are exposed to moisture.
Subflooring†	SHEATHING SPAN - Square edge	7/16 1/2 5/8 3/4	16 16 20 24	Apply panels perpendicular to supports. Space panels 1/8". Cover with minimum 1/4" underlayment**, accepted lightweight or gypsum concrete**, structural wood flooring**, or block edges. Fasten 1/2" or less using 6d common, thicker panels using 8d deformed shank or equivalent.
Roof Sheathing (Except for flat roofs used as walking decks)	SHEATHING SPAN - Square edge	3/8 7/16 1/2 5/8 3/4	24*** 24 32*** 40*** 48***	Apply panels perpendicular to supports. Space panels 1/8". Ensure panels are applied with textured, Slip-Gard surface up. Suggested fasteners are the same as for subflooring. When used, H-clips aid in properly spacing panel edges.
Wall Sheathing	SHEATHING SPAN - Square edge	3/8 and greater	24	Panels may be applied parallel or perpendicular to supports. Space panels 1/8". All panel edges shall be supported by blocking for wall sections used in lieu of let-in corner bracing. Suggested fasteners are the same as for subflooring.
Ceilings and Soffits	SHEATHING SPAN - Square edge	3/8 and greater	24	Apply panels perpendicular to supports. Space panels 1/8". Suggested fasteners are the same as for subflooring. Protect the underside of exposed NORBORD OSB soffit with a quality exterior paint system.
Utility	Not Applicable	1/4	16	No code approvals available for structural uses. Excellent Do-It-Yourself panels for decorative and general purpose use. Space panels 1/8". For best results use blocking along all edges and at mid length. Refer to general information above and use sound construction methods. Recommend vapour barrier on warm side of wall if used in panelling type application.

* Suitable as base for carpet, wood strip or parquet flooring

** Follow material manufacturers' instructions.

*** Edge support required at maximum span. Use panel edge clips (two between supports spaced 48" o.c.), Tongue and Groove edges (available only on 5/8" and 3/4"), lumber blocking or other.

† If finished floor is to be adhesive-bonded resilient flooring always use an approved underlayment following the manufactures' instructions, over NORBORD

Limitation of Liability

In no event shall the liability of Northwood Panelboard Co., under any claim made by any buyer, exceed the purchase price of the products in respect of which damages are claimed.

NORBORD is manufactured at Solway, Minnesota



WAferwood®

LP Louisiana-Pacific

**Louisiana-Pacific
brings a
multi-purpose
panel to the
construction
industry.**

A new dimension in versatility.

What is Waferwood? It's a versatile exterior structural building material consisting of engineered waters of various widths yet carefully controlled length and thickness. The board consists of multi-layers of wood wafers bonded together under extreme heat and pressure with a waterproof and phenolic resin. The result is a rigid, flat panel dimensionally stable and equally strong in all directions that is virtually free of formaldehyde odor. It

is an ideal material for interior and exterior use which may be finished natural, stained or painted.

Waferwood Workability

The physical properties of L-P Waferwood make it an excellent choice for a wide variety of applications.

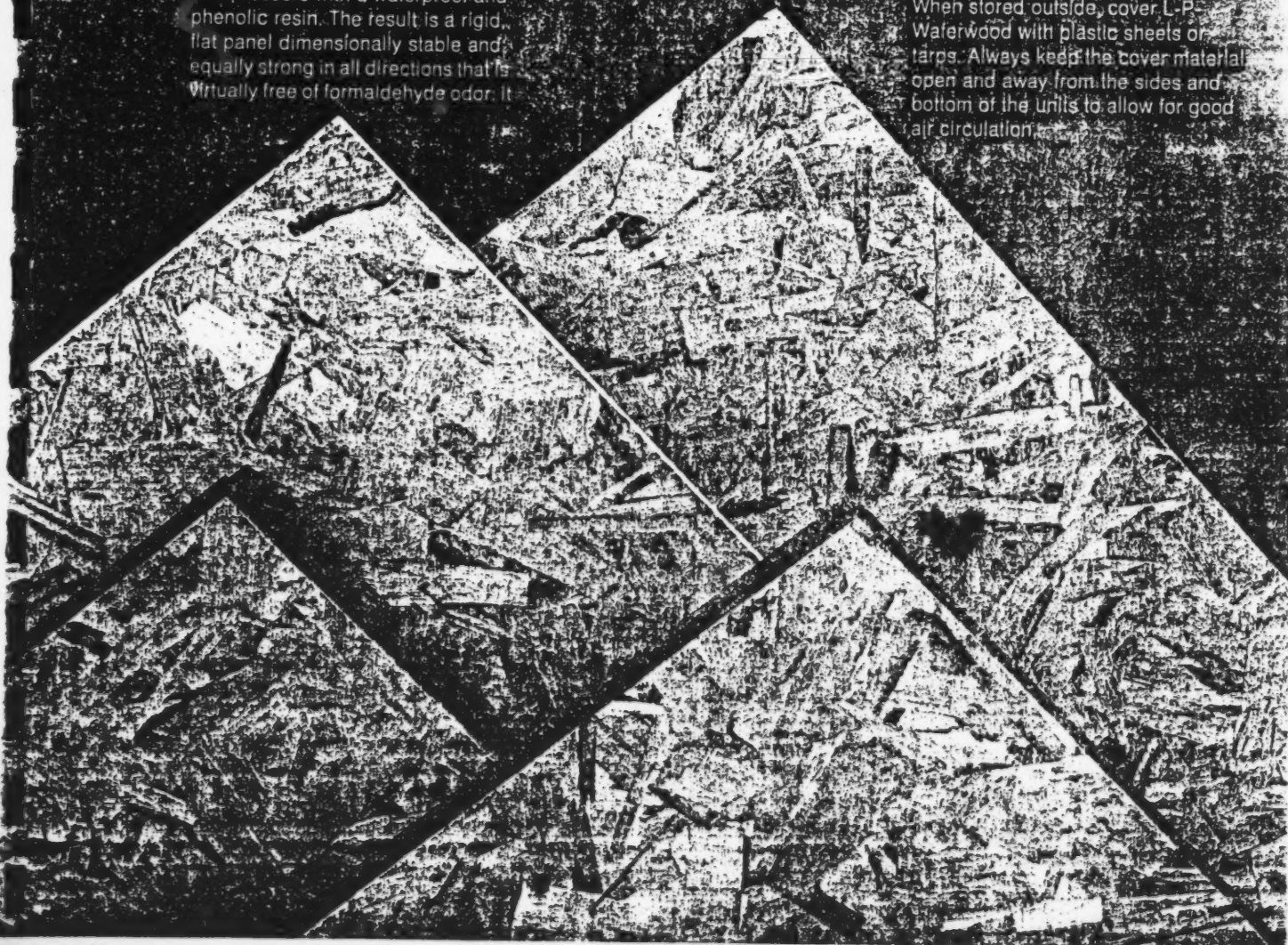
The panel is lightweight, relatively smooth on both sides and free of knots, core voids, splits and checks. Waferwood has an excellent MOR and MOE and a low coefficient of lineal expansion. The panel fastens easily with conventional nailing or stapling techniques and saws cleanly, drills and routs with standard woodworking tools.

Applications Unlimited

With seven available thicknesses, 1/4" through 3/4", Waferwood quickly becomes an optimum building material for a wide variety of applications. Sold in standard 4' x 8' panels, Waferwood is a natural choice for roofs, siding, walls and soffits. Additional uses include fencing, tool and garden sheds, farm structures, interior wall paneling, storage and decorative DIY homeowner projects.

Waferwood Storage

Store L-P Waferwood in a clean, dry area. Never store Waferwood in direct contact with the ground. L-P Waferwood should be stored indoors or under cover whenever possible. When stored outside, cover L-P Waferwood with plastic sheets or tarps. Always keep the cover material open and away from the sides and bottom of the units to allow for good air circulation.



WAFERWOOD®

Before installation, Waferwood should be allowed to acclimate to the surroundings for at least 24 hours. Where humid or moist conditions prevail, panels should be spaced a minimum of 1/8" apart at the joints.

L-P-Waferwood T&G APA Sturd-I-Floor

T&G Sturd-I-Floor® for a single flooring system is now available. The first waferboard to receive APA Sturd-I-Floor® approval, L-P-Waferwood is self-spacing and tongue and grooved to give you a single-floor system that is edge-sealed for added moisture protection.

Waferwood's uniform density, sanded surface and low linear expansion mean a strong, stiff, smooth floor. The APA approval allows 5/8" Waferwood to be applied directly to joists spaced 16" o.c., and 3/4" over joists spaced 24" o.c. L-P-Waferwood Sturd-I-Floor panels used with non-textile resilient flooring must be covered with a 1/4" minimum thickness underlayment.

For further storage and application instructions refer to American Plywood Association "Panel Care and Installation" Form No. F800 and "APA Construction Guide-Residential and Commercial" Form No. E30A.

Waferwood Panel Products

Waferwood is now produced in two grooved patterns. A reverse board and batten (RB&B) 12" o.c. and a channel grooved pattern, 8" o.c. Both are available in 3/8" and 7/16" thicknesses, in square edge only.

The Waferwood Roof

Waferwood in 7/16" thickness is allowed over roof supports spaced 24" o.c. The panel is available with a screen textured surface. This skid resistant, coarse textured surface gives considerably safer footing on steeply pitched roofs compared to the rough sanding or green resin coating used by other manufacturers. Waferwood roof sheathing is sealed on all four edges with an orange edge sealer for greater stability under all weather conditions.

Waferwood Packaging

Thickness	Est. Average Weight per M sq. ft.	Pieces per Bundle
1/4"	900 lbs.	135
5/16"	1015 lbs.	110
3/8"	1220 lbs.	90
7/16"	1385 lbs.	80
1/2"	1540 lbs.	70
5/8"	1875 lbs.	55
5/8" T&G	1875 lbs.	50
3/4"	2190 lbs.	45
3/4" T&G	2190 lbs.	44

For roof application, stagger end joints a minimum of one support spacing in succeeding panel rows. A minimum 1/8" gap should be provided between all panel edges. A plyclip must be used at the panel edges between roof supports or solid wood blocking installed along the unsupported edges. Six penny (6d) common nails spaced 6" apart along the panel edges and 12" o.c. in the field are required.

3/8" thick Waferwood panels may be used with plyclips over roof rafters spaced 16" o.c.

The Waferwood Wall

Either 3/8" or 7/16" Waferwood may be used on studs spaced up to 24" o.c. with panels applied either horizontally or vertically. Horizontal applications require staggered vertical joints at least one stud space. Provide 1/16" minimum gap between all panel edges. Six penny (6d) common nails spaced 4" o.c. along all panel edges and 12" o.c. on intermediate supports are required. The material provides sufficient racking strength to eliminate the need for corner bracing.

For exterior use or interior wall paneling, 1/4" Waferwood may be applied over studs 16" o.c.

Waferwood Soffits

Waferwood in 3/8" thickness is allowed for soffit application on 16" and 24" center supports. Corrosion resistant six penny (6d) nails are recommended.

Waferwood Acceptability

Waferwood carries the CRT quality stamp of Columbia Research and Testing which certifies that Waferwood meets performance standards for grade 2-MW under American National Standard ANSI A208.1-79. Waferwood is accepted by the Council of American Building Officials National

Research Board Report No. 124 and conforms to HUD/FHA Materials Release No. 996.

Waferwood T&G panels meet performance standards for APA Sturd-I-Floor® and is accepted by the Council of American Building Officials National Research Board Report No. 108 and conforms to HUD/FHA Release No. 1060.

The Waferwood Process

Waferwood panels are manufactured from roundwood cut into random width wafers with thin, longer wafers on the surface and thicker, shorter dimensioned wafers in the core. The wafers are coated with a waterproof resin and wax, then bonded under heat and pressure in a twelve opening, 8' x 16' press.

Physical Properties

Density - 40 lbs./cu. ft.
Modulus of rupture - 2,500 psi
Modulus of elasticity - 450,000 psi
Internal bond - 50 psi
Linear expansion - 0.20%
Minimum direct nail withdrawal - 25 lbs.

Surface Burning Characteristics

Unfinished 1/4 to 3/4 in.

Basic Board

Flame Spread	195
Fuel Contributed	150
Smoke Developed	100

Above Classifications Certified by Underwriters Laboratories Control Number 11H7.

LP Louisiana-Pacific
The smart wood power

111 S.W. Fifth Avenue
Portland, Oregon 97204



OSB Structural Panels

Installation Instructions

Site-Built and Modular Construction

- | | |
|----------------------|------------------|
| Economical | No Patches |
| Uniform | No Splits |
| Solid | No core voids |
| Code Accepted | No knotholes |
| 100% Aspen | No pitch pockets |
| Dimensionally Stable | |
| Exterior Resins | |

Important Notice to Buyers and Users of Huber Materials:

These instructions are not intended to cover every installation requirement, detail, or variation, nor do they provide for every possible installation contingency. If any questions or problems arise concerning the installation of this product or its suitability for a particular use, inquiries should be made to Huber. The information about products and application instructions printed herein is current at the time of publication; however, in accordance with Huber's policy of constant product improvement, the right is reserved to vary these installation instructions and product specifications without notice. Please ask for the most recent product information when placing your order.

Description

Huber OSB is a structural panel made of wood strands aligned in three perpendicular layers and bonded with waterproof phenolic resin. Panels have greater strength in the long dimension than across the width.

Applications

Panels may be used in light framing construction for wall and roof sheathing, subfloors, combination subfloor/underlayment and many utility/industrial applications. Panels are not recommended for residential siding.

Certification

Panels 3/8" and thicker are certified by TECO Products & Testing Corp. as complying with TECO Sheathing Span or Floor Span performance rated requirements, NEB-133.

Code Compliance

Sheathing and subfloor panels meet requirements of the HUD Manufactured Home Construction and Safety Standards, model building codes and most local codes. All performance rated panels have HUD/FHA acceptance under Materials Release #MR-1130a.

Fire Rating

3/8" and thicker have been generically recognized as having a Class C (III) flame spread rating without need for test or label by: HUD/FHA Manual of Acceptable Practices, Section 405-8 to the Minimum Property Standards.

Interpretive Bulletin C-1-76 to the HUD Manufactured Home Construction and Safety Standards.

Size and Thickness

4'x8': 1/4", 3/8", 7/16", 1/2", 5/8", 3/4" square edge; 5/8" and 3/4" available with tongue and groove edges, sanded and edge sealed. Net face width is 47 1/2" on tongue and groove panels. Special sanding and cutting are available.

Span Ratings

<u>Sheathing Span</u>	<u>Floor Span</u>
3/8" - 20/0	5/8" - 20" o.c.
7/16" - 24/16	3/4" - 24" o.c.
1/2" - 32/16	
5/8" - 40/20	
3/4" - 48/24	

General Construction Notes

Storage

Store to avoid excessive moisture pick-up. If possible, store in a warehouse or under cover. Keep panels off concrete floors or the ground. Outdoors, cover panels loosely with some type of waterproof protective material. Anchor covers on top of stack but away from the sides and bottom to ensure good air circulation. Allow 24 hours for panels to acclimatize to the surrounding environmental conditions prior to installation. Whenever excessive moisture pick-up is expected, cut the steel banding on the stack to prevent edge damage.

Handling

Handle with reasonable care. Avoid dropping on edges. When using a fork lift, put the stack on a pallet or supports to minimize damage from fork tines. Panels are designated as Exposure 1 durability. They are intended for protected construction applications where ability to resist moisture during long construction delays is required. If subjected to heavy rains or standing water during normal construction, the panel edges may swell and mild surface roughening may occur. These are normal reactions to water for compressed wood products. If edge swelling and surface roughening are encountered, touch sand where necessary after panels are dry.

Cutouts

Cutouts for plumbing and electrical components should be oversized by at least 1/4" to avoid a force fit.

Workability

Huber OSB saws, drills, and routs with standard woodworking tools.

Fastening

Fasten to within 3/8" of panel edges using the fastener size and spacing recommended in the application table.

Panel Application

Spacing

Provide 1/8" minimum gap between panel edges, and under extremely moist or humid conditions, increase gap to 1/4". Stagger end joints in succeeding panel rows a minimum of one support spacing.

Provide 3/4" minimum gap where floor panels meet concrete or masonry walls and a 3/4" expansion joint where floor panel sections run continuous for 80' or more.

Wall Sheathing

Apply direct to studs with long dimension parallel or perpendicular to framing. Corner bracing to resist racking loads not needed.

Cover with a weather resistant cladding such as any commercially available exterior grade siding.

Roof Sheathing

Apply with long dimension perpendicular to framing. Protect with weatherproof roof material such as asphalt impregnated felt and asphalt shingles or similar materials currently accepted by model code authorities and existing standards for the intended application.

Flooring

Subfloor Panels (two layer floors)

Apply with long dimension perpendicular to floor framing. Cover with a separate 1/4" or thicker underlayment, 25/32" wood strip flooring, 1-1/2" of approved cellular or lightweight concrete or edges shall be supported with blocking.

Combination Subfloor/Underlayment

OSB 5/8" and 3/4" thick can be used as combination subfloor/underlayment (single floor) panels when applied with the long dimension perpendicular to supports in factory built, mobile home and site-built construction. Panel edges must be tongue and groove or supported by blocking. Install panels according to instructions marked on face of panels. If subfloor or combination subfloor/underlayment panels are subjected to heavy rains or standing water during normal construction, the panel edges may swell and mild surface roughening may occur. Where necessary, touch sand after

the panels are dry. Install a separate underlayment in areas to receive vinyl roll or tile floor coverings. For houses built over crawl spaces, provide clearance, moisture control and ventilation as required by codes.

Stapling

For application where sidewall, roof and subfloor constructions do not have to meet shear wall or diaphragm strength criteria, staples may be used for fastening. Complies with HUD/FHA UM 25d, Applications and Fastening Schedule: Tables XVI and XVIII.

Miscellaneous Applications

Panels may be used for interior paneling, home craft projects, shelving, crating, sheds, outbuildings, garages, fences, and storage bins; virtually an unlimited number of non-code compliance uses. Use a fastener whose length will penetrate the framing member by at least 1". Space fasteners 6" o.c. at the perimeter and 12" o.c. at intermediate locations. Maximum span for 1/4" thick is 16". Provide a minimum 1/8" gap along all panel edges.

Finishing

For interior use, panels can be left natural or stained, varnished, or painted. In permanently exposed utility applications, it is recommended that panels be painted, including all edges. For maximum weathering protection, finish with a high quality, two-coat paint system comprised of a stain blocking primer with a compatible top-coat.

The preferred system is one unthinned brush-applied coat of latex stain-blocking primer followed by one unthinned brush-applied coat of 100% acrylic latex paint.

Exterior solid color stains may be used; however, a stain-blocking primer is recommended prior to staining. Stains do not provide the same degree of weathering protection as paints and will require more frequent refinishing. Semi-transparent stains and clear water-repellent finishes are not recommended for exterior applications.

Code Compliance

TABLE I Sheathing Span Allowable Spans - Huber OSB (NEB-133) Wall Sheathing¹

Panel Span Rating	Panel Thickness (Inches)	Maximum Stud Spacing, Inches O.C.		Fastener Size ²	Fastener Spacing, ³ Inches O.C.	
		When Siding is Nailed thru Sheathing to Studs	When Siding is Nailed to Sheathing		Edges	Intermediates
20/0	3/8	16	16	6d (2") common nail or 7/16" crown, 15 ga. staple, 1-1/2" legs ¹	6	12
24/16	7/16	24	24			
32/16	1/2	24	24			

¹Panels may be installed with the long dimension parallel or perpendicular to framing members.

²For diaphragm constructions see applicable Tables in NEB-133.

³See instructions on stapling.

NOTE: HUBER OSB IS NOT RECOMMENDED FOR RESIDENTIAL SIDING.

TABLE II Sheathing Span Allowable Spans and Uniform Live Loads-Huber OSB (NEB-133) ROOF SHEATHING¹

Panel Span Rating	Panel Thick- ness(In.)	Maximum Span (In.) ¹		Allowable Live Loads (PSF)							Fastener Size ²	Fastener Spacing ² Inches O.C.	
		With Edge Support ⁴	Without Edge Support	Spacing of Supports Center to Center (Inches)								Edges	Intermediates
				12	16	20	24	32	40	48			
20/0	3/8	20	16	70	50	30					6d (2") common nail or 7/16" crown, 15 ga. staple, 1-1/2" legs	6	12
24/16	7/16	24	24	135	100	75	40					6	12
32/16	1/2	32	28	135	100	75	55	30				6	12
40/20	5/8	40	32	165	120	100	75	55	30		8d (2 1/2") common nail or 7/16" crown, 14 ga. staple, 2" legs	6	12
48/24	3/4	48	36	210	155	130	100	65	50	35		6	12

¹Panels are continuous over two or more spans and applied with the long dimension perpendicular to framing members.

²For diaphragm constructions see applicable Tables in NEB-133.

³The allowable spans were determined using a dead load of 10 psf. If the dead load exceeds 10 psf, then the live load should be reduced accordingly.

⁴Tongue and groove edges, H-clips, lumber blocking, or other.

⁵See instructions on stapling.

⁶For 48 inch on center span, space nails 6 inches on center throughout.

Warning — Huber OSB sheathing may be extremely slippery when wet, covered with frost, ice or snow or when covered with sawdust. Installers of Huber OSB should wear rubber soled footwear and exercise caution, especially on roof slopes exceeding 4 in 12.

TABLE III Sheathing Span Allowable Spans - Huber OSB (NEB-133) SUBFLOOR^{1,4}

Panel Span Rating	Panel Thickness (Inches)	Maximum Span ² Inches O.C.	Fastener Size ³	Fastener Spacing ³ Inches O.C.	
				Edges	Intermediates
24/16	7/16	16	6d nail or 7/16" crown, 15 ga. staple, 1-1/2" legs ¹	6	10
32/16	1/2	16		6	10
40/20	5/8	20 ⁵	8d nail or 7/16" crown, 14 ga. staple, 2" legs ¹	6	10
48/24	3/4	24		6	10

¹Panels are continuous over two or more spans and applied perpendicular to framing members.

²Panels may be used at the rated floor span, with a live load not to exceed 85 psf and a dead load not to exceed 25 psf.

³For diaphragm constructions see applicable Tables in NEB-133.

⁴Panels shall be covered with 1/4" or thicker underlayment, or 1-1/2" inches of approved cellular or lightweight concrete, gypsum concrete, or 2x4" or 6x6" wood strip finish flooring or edges shall be supported with blocking.

⁵Ring or screw shank nails recommended.

⁶See instructions for stapling.

⁷Span may be 24" if covered by 25/32" wood strip flooring at right angles to joists.

⁸Span may be 24" if covered by 1-1/2" of approved lightweight cellular concrete.

TABLE IV Floor Span Allowable Spans-Huber OSB (NEB-133) COMBINATION SUBFLOOR/UNDERLAYMENT^{1,4}

Panel Span Rating	Panel Thickness (Inches)	Maximum Span ² Inches O.C.	Fastener Size ³	Fastener Spacing ³ Inches O.C.	
				Edges	Intermediates
20" o.c.	5/8	20	6d ring or screw shank nail or 7/16" crown, 14 ga. staple, 2" legs ⁵	6	10
24" o.c.	3/4	24		6	10

¹Panels are continuous over two or more spans and applied perpendicular to framing members.

²Panels may be used at the rated floor span, with a live load not to exceed 85 psf and a dead load not to exceed 25 psf.

³For diaphragm constructions see applicable Tables in NEB-133.

⁴If glue-nailed, use a structural adhesive that complies with APA Specification AFG-01.

⁵8d common nails may be substituted if deformed shank nails are not available.

⁶See instructions for stapling.

T-Strand by Temple-EastTex



T-Strand is certified by the American Plywood Association (APA) as a structural-use panel, designed and manufactured specifically for protected residential and other light frame construction applications. *It is rated by the APA for roof sheathing, sub-floor*

construction, wall sheathing and Sturd-I-Floor.

T-Strand is ideally suited for a wide variety of do-it-yourself applications, including shelving and other homecraft projects.

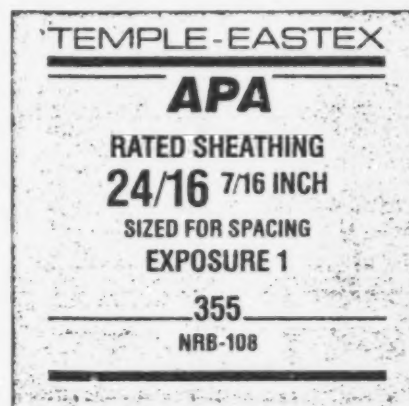
T-Strand is also used for crating and other industrial applications.

DESCRIPTION:

T-Strand, Oriented Strandboard, is a multi-ply structural-use panel made of compressed strand-like wood particles bound together with phenolic resins.

1. Exposure 1—All T-Strand will have an Exposure 1 designation. Panels with this designation are intended for protected construction uses where sufficient durability is required to resist moisture exposure due to long construction delays or other conditions of similar severity. *Panels should be stored off the ground and protected from the weather.*
2. Dimensional Tolerance and Squareness of Panels—
 - a) Size—A tolerance of plus 0, minus $\frac{1}{16}$ inch shall be allowed on specified length and/or width.

- b) Thickness—Tolerance of plus or minus $\frac{1}{32}$ inch shall be allowed on the trademark-specified thickness.
- c) Squareness and Straightness—Panels shall be square within $\frac{1}{64}$ inch per lineal foot measured along the diagonals. All panels shall be manufactured so that a straight line drawn from one corner to the adjacent corner is within $\frac{1}{16}$ inch of the panel edge.
3. Identification—All T-Strand Board APA Rated Sheathing and Sturd-I-Floor shall be identified with an APA trademark bearing the APA Rated Sheathing designation appropriate under these specifications. The manufactured nominal thickness, span rating, and exposure shall be included.



WALL SHEATHING CONSTRUCTION

INSTALLATION

Panels shall be continuous over two or more spans. Panels may be installed with the major panel axis either along or across studs. All panel edges shall be nailed to framing for wall sections acting as bracing. Panel end joints shall occur over framing. Panel end joints should be spaced $\frac{1}{16}$ inch, and panel edges should be spaced $\frac{1}{8}$ inch. When wet or humid conditions are expected, these spacings should be doubled.

ALLOWABLE SPANS AND FASTENING RECOMMENDATIONS

A: Values are for 16 gauge galvanized wire staples with minimum crown width of $\frac{1}{8}$ inch.

B: Minimum nailing distance from edge— $\frac{1}{8}$ inch.

Identification Index	Panel Thickness (In.)	Maximum Stud Spacing (In.) Exterior Covering Nailed to		Nail Size	Nail Spacing (In.)		Stapling (A)		
		Stud	Sheathing		Panel Edges Cover Framing	Inter-mediate (Each Stud)	Leg Length (In.)	Spacing Perimeter (In.)	Spacing Inter-mediate (In.)
24/0	$\frac{3}{4}$ "	24	16 24	6d	6	12	1 $\frac{1}{4}$	4	8
24/16	$\frac{7}{16}$ "	24	24	6d	6	12	1 $\frac{1}{2}$	4	8
32/16	$\frac{1}{2}$ "	24	24	6d	6	12	1 $\frac{1}{2}$	4	8

TYPICAL PHYSICAL PROPERTIES	UNIT OF MEASURE	TEST RESULTS	
		7/16"	1/4"
Density	PCF	41	39.5
Modulus of Rupture Parallel Perpendicular	PSI	5000 2500	4200 2000
Modulus of Elasticity Parallel Perpendicular	PSI	800,000 350,000	600,000 300,000
Internal Bond Minimum	PSI	55	50
Linear Expansion Maximum Parallel Perpendicular	%	0.25 0.45	.25 .45
Maximum Moisture Content	%	6	6
Thickness Tolerance Maximum Deviation	inches	± 0.025	± 0.030
Length & Width Tolerance Maximum Deviation	inches	+ 0. - 1/8	+ 0. - 1/8
Squareness Tolerance Maximum Deviation	inches	1/8	1/8

STURD-I-FLOOR 20 AND 24 OC

T-Strand APA rated Sturd-I-Floor is intended for use as a combination subfloor and underlayment.

INSTALLATION

The major panel axis (the long dimension) shall be placed across supports spaced no farther apart than shown on the trademark (in inches on center). Panels shall be continuous over two or more spans. Glue-nailing is recommended for Sturd-I-Floor panels, though nailing without glue is acceptable. When applying thin resilient finish flooring, a layer of underlayment is recommended. Otherwise, set nails 1/16 inch, but do not fill nail holes. Fill edge joints and thoroughly sand any surface roughness, particularly at joints and around nails.

ALLOWABLE SPANS AND FASTENING RECOMMENDATIONS

A. Use only adhesives conforming to APA specification AFG-01. Apply continuous

bead of glue on joints (double bead under butted joints) and in tongue and groove joint.
B. 8d common nails may be substituted if deformed shank nails are not available.

Span Rating (Minimum Joist Space) (In.)	Panel Thickness (In.)	Fastening: Glue-Nailed (A)			Fastening: Nailed Only		
		Nail Size and Type (B)	Spacing (In.)		Nail Size and Type	Spacing (In.)	
			Panel Edges	Intermediate		Panel Edges	Intermediate
20	5/8	6d deformed shank	12	12	6d deformed shank	6	10
24	3/4	6d deformed shank	12	12	6d deformed shank	6	10

SUB-FLOOR CONSTRUCTION

INSTALLATION

The major panel axis (the long dimension) shall be placed across the supports spaced no further apart than shown on the trademark (in inches-on-center). Panels shall be continuous over two or more spans. A separate structural finish floor or underlayment shall be installed over the sub-floor. Panel end joints shall occur over framing. Panel end joints should be spaced $\frac{1}{16}$ inch, and panel edges should be spaced $\frac{1}{8}$ inch. When wet or humid conditions are expected, double these spacings.

ALLOWABLE SPANS AND FASTENING RECOMMENDATIONS

A: Values are for 16 gauge galvanized wire staples with minimum crown of $\frac{3}{8}$ inch.

Identification Index	T-Strand Thickness (in.)	Maximum Span (in.)	Nail Size & Type	Nail Spacing (in.)		Stapling (A)		
				Panel Edges	Inter-mediate	Leg Length	Spacing Perimeter	Spacing Inter-mediate
24-16	7-16	16	6d Common	6	10	1-5/8	4	7
32-16	1-2	16	6d Common	6	10	1-5/8	4	7
42-20	5-8	20	8d Common	6	10	1-5/8	2-1/2	4
48-24	3-4	24	8d Common	6	10	—	—	—

ROOF SHEATHING

INSTALLATION

The major panel axis (the long dimension) shall be placed across the supports spaced no farther apart than shown on the trademark (in inches-on-center). For open soffits, the underside of the panels may be exposed. The edges should be protected from the weather. Panels shall be continuous over two or more spans. Panel end joints shall occur over framing. Panel end joints should be spaced $\frac{1}{16}$ inch, and panel edges should be spaced $\frac{1}{8}$ inch. When wet or humid conditions are expected, double these spacings.

ALLOWABLE SPANS AND UNIFORM LIVE LOADS FOR ROOF DECKING

A: Edge support necessary, such as tongue-and-groove edges,

panel edge clips (one between each set of supports except two between supports 48" on center), lumber blocking or other.

B: A 10 psf dead load may be added to the listed live loads.

Identification Index	OSB Thickness (in.)	Maximum Span (in.) (A)	Unsupported Edge Max Length (in.)	Allowable Live Loads (psf)							
				Spacing of Supports Center to Center in Inches							
				12	16	20	24	32	42	48	
24-0	3-8	24	20	90	65	55	30	—	—	—	
24-16	7-16	24	24	135	100	75	40	—	—	—	
32-16	1-2	32	28	135	100	75	55	30	—	—	
40-20	5-8	40	32	165	120	100	80	55	35	—	
48-24	3-4	48	36	210	155	130	100	65	45	35	

ROOF DECK FASTENING RECOMMENDATIONS

- A: Use common smooth or deformed-shank nails with T-Strand up to $\frac{3}{4}$ inch.
- B: All values are for 16 gauge galvanized wire staples with minimum crown of $\frac{3}{8}$ inch.
- C: For spans of 48 inches, space nails 6 inches at all supports.
- D: Minimum distance from edge — $\frac{3}{8}$ inch.

T-Strand Thickness (in.)	Nailing (A)			Stapling (B)		
	Size	Spacing (in.)		Leg Length	Spacing (in.)	
		Panel Edges	Intermediate		Panel Edges	Intermediate
3-8	6d	6	12	1-3/8	4	8
7-16	6d	6	12	1-1/2	4	8
1-2	6d	6	12	1-1/2	4	8
5-8	8d	6	12	—	—	—
3-4	8d	6	2 (C)	—	—	—



Temple-EastTex
INCORPORATED

Diboll, Texas 75941 1-800-231-6060

ELMENDORF OSB FOR ROOF SHEATHING

INSTALLATION

The major panel axis (the long dimension) shall be placed across supports spaced no farther apart than shown on the trademark (in inches-on-center). For open soffits, the underside of the panels may be exposed. The edges should be protected from the weather. Panels shall be continuous over two or more spans. Panel end joints shall occur over framing. Panel end joints should be spaced 1/16 inch, and panel edges should be spaced 1/8 inch. When wet or humid conditions can be expected, these spacings should be doubled.

OSB ROOF SHEATHING

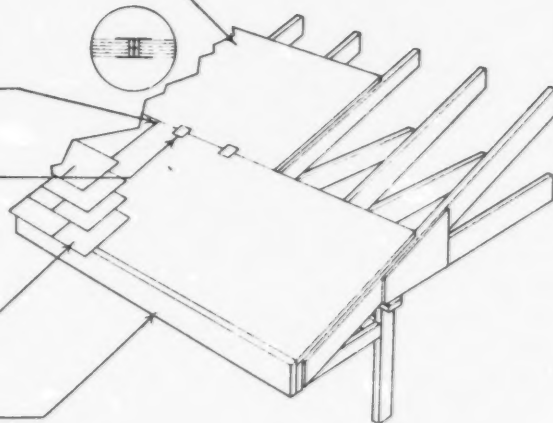
OSB sheathing

Leave 1/16" space at all panel end joints and 1/8" space at all panel edge joints. When wet or humid conditions can be expected, double these spacings

Panel clip or tongue-&-groove edges if required

Asphalt, asbestos, or wood shingles or shakes. Follow roofing mfr's recommendations for roofing felt

Protect edges of OSB against exposure to weather



Allowable Spans and Uniform Live Loads for Roof Decking

A: Edge support necessary, such as tongue-and-groove edges, panel edge clips (one between each set of support except two between supports 48" on center), lumber blocking, or other

B: A 10 psf dead load may be added to the listed live loads

Identification Index	OSB Thickness (in.)	Maximum Span (in.) A	Unsupported Edge Max. Length (in.)	Allowable Live Loads (psf)							
				Spacing of Supports Center to Center in Inches							
				12	16	20	24	32	42	48	
24/0	3/8	24	20	90	65	55	30	—	—	—	
24/16	7/16	24	24	135	100	75	40	—	—	—	
32/16	1/2	32	28	135	100	75	55	30	—	—	
42/20	5/8	42	32	165	120	100	80	55	35	—	
48/24	3/4	48	36	210	155	130	100	65	45	35	

Roof Deck Fastening Recommendations

A: Use common smooth or deformed-shank nails with OSB up to 3/4 inch.

B: All values are for 16 ga. galvanized wire staples with min. crown of 3/8 inch

C: For spans of 48 inches, space nails 6 inches at all supports

D: Minimum distance from edge — 3/8 inch.

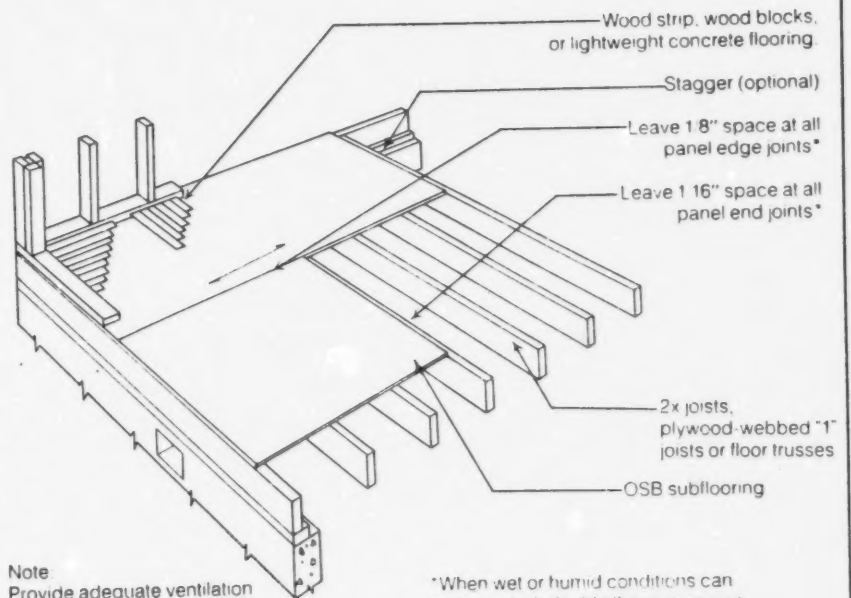
OSB Thickness (In.)	Nailing (A)			Stapling (B)		
	Size	Spacing (In.)		Leg Length	Spacing (In.)	
		Panel Edges	Intermediate		Panel Edges	Intermediate
3/8	6d	6	12	1-3/8	4	8
7/16	6d	6	12	1-1/2	4	8
1/2	6d	6	12	1-1/2	4	8
5/8	8d	6	12	—	—	—
3/4	8d	6	2 (c)	—	—	—

LMENDORF OSB FOR SUB-FLOOR CONSTRUCTION

INSTALLATION

The major panel axis (the long dimension) shall be placed across the supports spaced no farther apart than shown on the trademark (in inches-on-center). Panels shall be continuous over two or more spans. A separate structural finish floor or underlayment shall be installed over the sub-floor. Panel end joints shall occur over framing. Panel end joints should be spaced 1/16 inch, and panel edges should be spaced 1/8 inch. When wet or humid conditions can be expected, double these spacings.

OSB SUB-FLOORING



Allowable Spans and Fastening Recommendations

A: Values are for 16 ga. galvanized wire staples with minimum width of 3/8 inch.

Identification Index	OSB Thickness (in.)	Maximum Span (in.)	Nail Size & Type	Nail Spacing (in.)			Stapling (A)	
				Panel Edges	Inter-mediate	Leg Length	Spacing Perimeter	Spacing Inter-mediate
24 16	7 16	16	6d Common	6	10	1-5/8	4	7
32 16	1 2	16	6d Common	6	10	1-5/8	4	7
42 20	5 8	20	8d Common	6	10	1-5/8	2-1/2	4
48 24	3 4	24	8d Common	6	10	-	-	-

ELMENDORF OSB FOR ROOF SHEATHING

INSTALLATION

The major panel axis (the long dimension) shall be placed across supports spaced no farther apart than shown on the trademark (in inches-on-center). For open soffits, the underside of the panels may be exposed. The edges should be protected from the weather. Panels shall be continuous over two or more spans. Panel end joints shall occur over framing. Panel end joints should be spaced 1/16 inch, and panel edges should be spaced 1/8 inch. When wet or humid conditions can be expected, these spacings should be doubled.

OSB ROOF SHEATHING

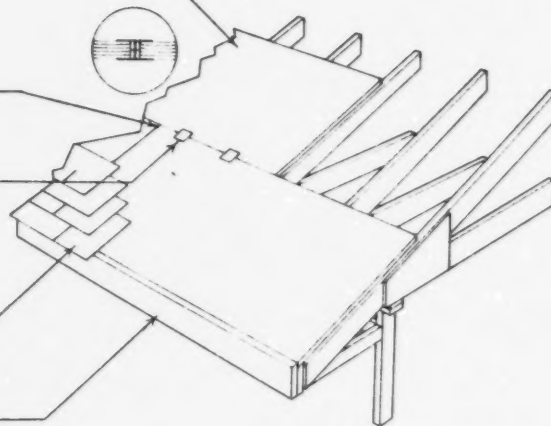
OSB sheathing

Leave 1/16" space at all panel end joints and 1/8" space at all panel edge joints. When wet or humid conditions can be expected, double these spacings.

Panel clip or tongue-&-groove edges if required

Asphalt, asbestos, or wood shingles or shakes. Follow roofing mfr's recommendations for roofing felt.

Protect edges of OSB against exposure to weather.



Allowable Spans and Uniform Live Loads for Roof Decking

A: Edge support necessary, such as tongue-and-groove edges, panel edge clips (one between each set of support except two between supports 48" on center), lumber blocking, or other.

B: A 10 psf dead load may be added to the listed live loads.

Identification Index	OSB Thickness (In.)	Maximum Span (In.) A	Unsupported Edge Max Length (In.)	Allowable Live Loads (psf)						
				Spacing of Supports Center to Center in Inches						
				12	16	20	24	32	42	48
24/0	3/8	24	20	90	65	55	30	—	—	—
24/16	7/16	24	24	135	100	75	40	—	—	—
32/16	1/2	32	28	135	100	75	55	30	—	—
42/20	5/8	42	32	165	120	100	80	55	35	—
48/24	3/4	48	36	210	155	130	100	65	45	35

Roof Deck Fastening Recommendations

A: Use common smooth or deformed-shank nails with OSB up to 3/4 inch.

B: All values are for 16 ga. galvanized wire staples with min. crown of 3/8 inch.

C: For spans of 48 inches, space nails 6 inches at all supports.

D: Minimum distance from edge — 3/8 inch.

OSB Thickness (In.)	Size	Nailing (A)		Leg Length	Stapling (B)	
		Spacing (In.)			Spacing (In.)	
		Panel Edges	Intermediate		Panel Edges	Intermediate
3/8	6d	6	12	1-3/8	4	8
7/16	6d	6	12	1-1/2	4	8
1/2	6d	6	12	1-1/2	4	8
5/8	8d	6	12	—	—	—
3/4	8d	6	2 (c)	—	—	—

ELMENDORF ORIENTED STRANDBOARD

Elmendorf Oriented Strandboard (OSB) is a multi-ply building board developed and tested over a period of 30 years for a full range of construction and industrial applications. It is rated by the American Plywood Association (APA) for roof sheathing, sub-floor construction and wall sheathing.

Elmendorf OSB is produced at a \$33-million plant in Claremont, NH. The manufacturing process utilizes readily available local softwoods and low-density hardwoods, which are reduced to thin, elongated strands. These strands are coated with phenolic resin and

arranged in three *oriented* layers, with the outside strands aligned lengthwise and the inside strands aligned crosswise. With the strands (and, thus, the grains) of each layer at right angles to the next, the layers are compressed under 500 psi at 400°F to produce a solid, three-ply panel with completely uniform stability.

Elmendorf OSB differs from waferboard, particleboard and other wood-fiber panels because of the greater bending strength in the lengthwise direction that results from its three oriented plies. It has two to three times the strength of the

other boards. Elmendorf OSB differs from plywood because of its complete, engineered uniformity. No unfilled knotholes or other voids can occur on OSB's surface or in its core.

Elmendorf OSB cannot delaminate, and its nail and screw holding characteristics are excellent.

Elmendorf OSB is intended for use in accordance with its Span Rating in inches and in accordance with the recommendations given below.

MOR 6,000 psi (lengthwise), MOE 900,000 psi, IB 60 psi

GENERAL

1. Exposure 1 – All Elmendorf OSB will have an Exposure 1 designation. Panels with this designation are intended for protected construction uses where sufficient durability is required to resist moisture exposure due to long construction delays or other conditions of similar severity. Panels should be stored off the ground and protected from the weather.
2. Dimensional Tolerance and Squareness of Panels –

- a) Size – A tolerance of plus 0, minus 1/8 inch shall be allowed on specified length and/or width.
- b) Thickness – Tolerance of plus or minus 1/32 inch shall be allowed on the trade-mark-specified thickness.
- c) Squareness and Straightness – Panels shall be square within 1/64 inch per lineal foot measured along the diagonals. All panels shall be manufactured so that a straight

line drawn from one corner to the adjacent corner is within 1/16 inch of the panel edge.

3. Identification – All Elmendorf Board APA Rated Sheathing shall be identified with an APA trademark bearing the APA Rated Sheathing designation appropriate under these specifications. The manufactured nominal thickness, span rating, and exposure shall be included.

ELMENDORF
APA

RATED SHEATHING
32/16 1/2 INCH
SIZED FOR SPACING
EXPOSURE 1

355

NRB-108

Swift, Reliable Delivery

For dealers, builders and manufacturers in the Northeast, Elmendorf can deliver its OSB swiftly and efficiently. It is therefore no longer necessary to warehouse unduly large supplies, simplifying inventory control.

Elmendorf OSB can be delivered in the full range of mixed loads.

This product is backed by prompt, efficient customer service.

Supplies of Elmendorf OSB are completely reliable. The supply of raw material for its manufacture is more than adequate now and is completely renewable for the future.

John E.

203

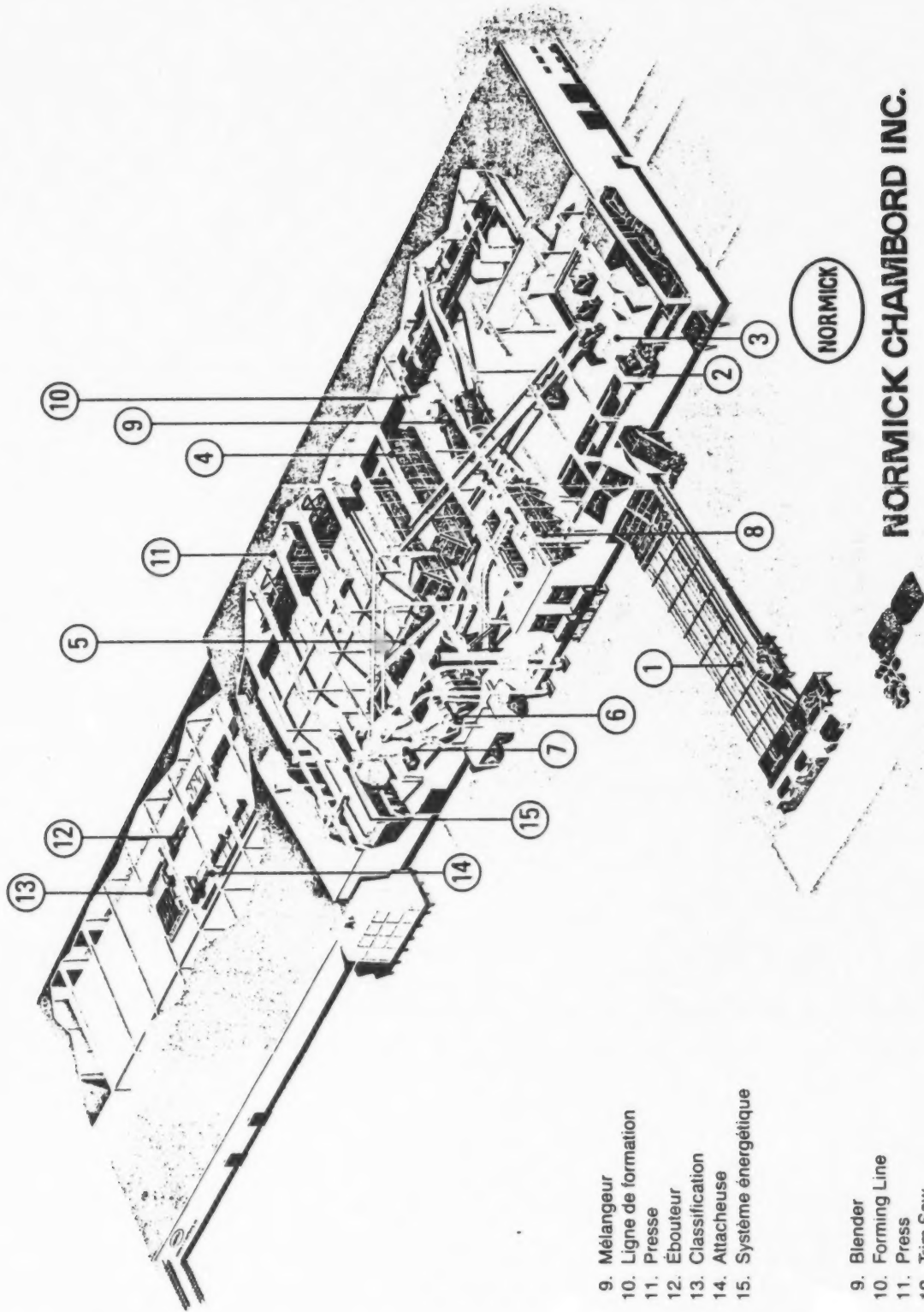
453-5858

ELMENDORF

GENUINE NEW ENGLAND OSB

Elmendorf Board Corporation
R.F.D. 2, River Road
Claremont, New Hampshire 03743
(603) 542-9912

Plunkett-Webster, Inc.
New Rochelle, New York
(914) 636-8770



NORMICK

NORMICK CHAMBORD INC.

LÉGENDE:

- | | |
|-----------------------|-------------------------|
| 1. Bassin | 9. Mélangeur |
| 2. Écorceur | 10. Ligne de formation |
| 3. Gaufrier | 11. Presse |
| Trémie gaulfre humide | 12. Ébouteur |
| 5. Séchoir | 13. Classification |
| 6. Tamis | 14. Attacheuse |
| 7. Cyclone | 15. Système énergétique |
| 8. Trémie gaulfre sec | |

LEGEND:

- | | |
|-----------------------|------------------------|
| 1. Hot Pond | 9. Blender |
| 2. Debarker | 10. Forming Line |
| 3. Waterizer | 11. Press |
| 4. Wet Strand Storage | 12. Trim Saw |
| 5. Dryer | 13. Grading Line |
| 6. Screen | 14. Strapping Line |
| 7. Cyclone | 15. Heat Energy System |
| 8. Dry Strand Storage | |

BREWSTERS

VISA®

MasterCard

A P.F. O'CONNOR COMPANY

PRICES IN EFFECT JULY 27 - AUGUST 8, 1987

WE HAVE

EVERYDAY LOW PRICES



82¢ EACH

2" x 4" x 7' PAD SPRUCE STUDS
Meets building code requirements. #012011



549 SHEET

1/2" ENERGY SHIELD SHEATHING
4' x 8' sheets. Foiled two sides. R-6.6. #183803



499 SHEET

1/2" or 3/8" x 4' x 8' GYPSUM WALLBOARD
Economical base for paint or wallpaper. Easy to apply.



1999 SQ. 6.25 Bundle

3 TAB FIBERGLASS ROOF SHINGLES
Standard 3 tab strips. 20 yr. lim. wty. Stock colors only. #110355

ALL AGENCY CERTIFIED
Compare Our Quality Before You Buy!

775 SHEET
1/2" x 4' x 8' CDX 3 PLY PLYWOOD
Agency certified. #133020

599 SHEET
7/16" x 4' x 8' WAFERBOARD
Exterior grade. Span rating 24/16. #133060

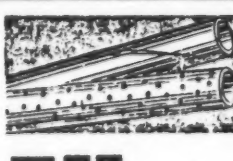
899 SHEET
5.2 x 4' x 8' EXT. GRADE LAUAN
Banded smooth. #123001

1430 SHEET
3/4" x 4' x 8' T&G SYP PLYWOOD
Agency certified. #133045



499 BAG

4 CU. FT. BAG PEAT MOSS
Loosens clay soil, binds sandy soil and preserves moisture.



375 EACH

4" x 10' SEWER & DRAIN PIPE
4" - perforated #730003 or solid #730002.

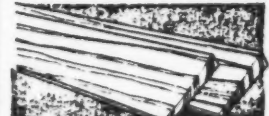


5295 CARTON

18" RED CEDAR #1 R&R SHINGLES
Resquared & rebutted. Covers 100 sq. ft. at 14" exposure.



4900 EACH
ORLEANS GLASS BIFOLD DOOR
Easy to install. Hardware included. 2'0" x 6'8". #210408



53¢ L.F.T.

1/2" x 8" CEDAR CLAPBOARDS
Grade A and better. K.D. 3'-20' lengths. #061012



14¢ SQ. FT.

OWENS CORNING FIBERGLAS INSULATION
3 1/2" x 15" & 23" kraft faced. R-11. #162600, #162700



999 SHEET

3/8" x 4' x 8' TEXTURE 1-11 SIDING
SYP, select grade. Rough sawn. 8" on center.

PLUS 2% DISCOUNT FOR CASH/CARRY

EVERYDAY LOW LUMBER PRICES

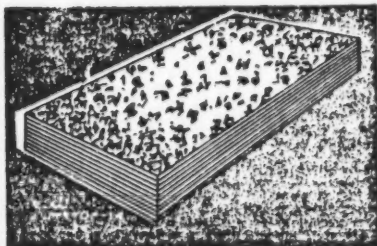


TYVEK HOUSEWRAP INSULATION

9' x 195' roll. Protects insulation R-value. Foil face 2 sides.

119⁹⁵ ROLL

#118000



7/16" x 4' x 8' WAFERBOARD

Exterior grade for indoors or out. Span rating 24/16. #133060

CHECK
OUR WEEKLY
CIRCULAR FOR
CURRENT
PRICES



DOW 2' x 8' TG INSULATION

Plastic foam sheathing. Use under new siding.

1" thick x 2' x 8'

2" thick x 2' x 8'

422

#184250
R-5.4

845

#184251
R-10.8



1/2" x 4' x 8' CDX PLYWOOD

Agency certified, 3 ply. SYP #133020

CHECK
OUR WEEKLY
CIRCULAR FOR
CURRENT
PRICES

4' x 8' CDX EXTERIOR PLYWOOD

AGENCY CERTIFIED

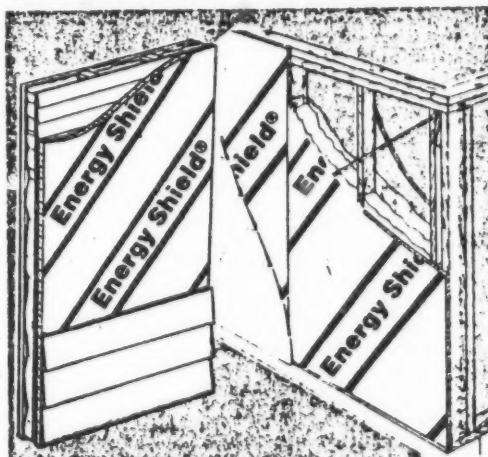
3/8" x 4' x 8' SYP #133010

1/2" x 4' x 8' 4/5 Ply Fir #133050

5/8" x 4' x 8' SYP #133030

3/4" x 4' x 8' SYP #133040

CHECK
OUR WEEKLY
CIRCULAR FOR
CURRENT
PRICES ON
PLYWOOD



4' x 8' ENERGY SHIELD SHEATHING

Foil 2 sides.

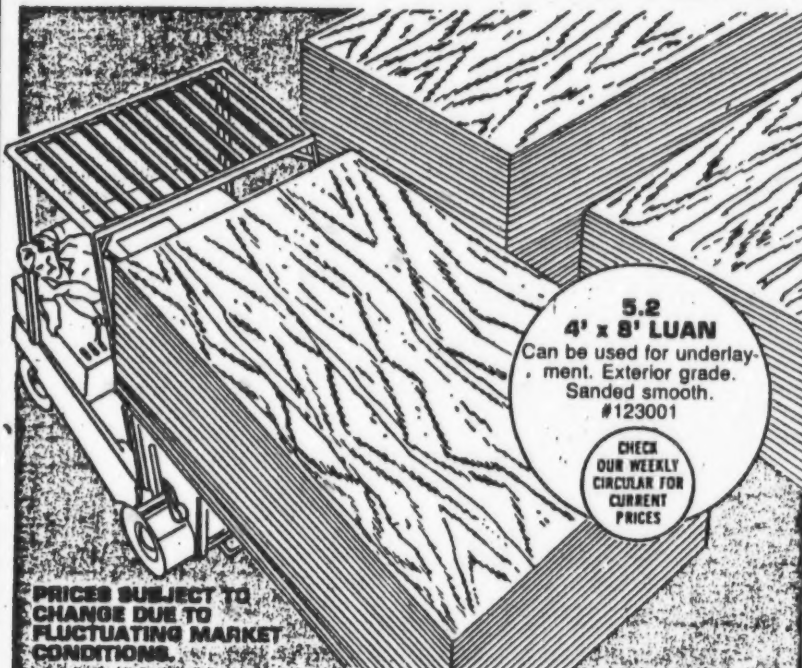
R-3.6 1/2"

R-7.2 1"

R-14.4 2"

CHECK
OUR WEEKLY
CIRCULAR FOR
CURRENT
PRICES

CHARGE IT.. MASTER CARD/VISA



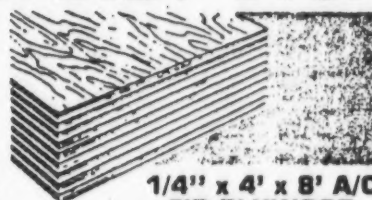
PRICES SUBJECT TO
CHANGE DUE TO
FLUCTUATING MARKET
CONDITIONS.

5.2
4' x 8' LUAN
Can be used for underlay-
ment. Exterior grade.
Sanded smooth.
#123001

CHECK
OUR WEEKLY
CIRCULAR FOR
CURRENT
PRICES

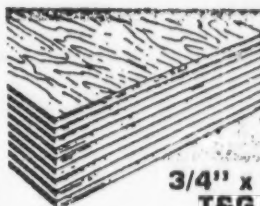
SIZE	4' x 8' SANDED EXT. PLYWOOD (AC GRADE)		4' x 8' FIR UNDERLAYMENT	
	SYP	FIR	SYP	FIR
3/8"	✓	✓	X	✓
1/2"	✓	✓	X	✓
5/8"	✓	X	✓	✓
3/4"	✓	✓	X	X

* Check our weekly circular for current prices on plywood.



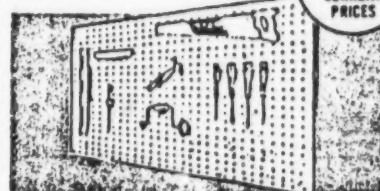
**1/4" x 4' x 8' A/C
FIR PLYWOOD**
#123010

CHECK
OUR WEEKLY
CIRCULAR FOR
CURRENT
PRICES



**3/4" x 4' x 8'
T&G SYP**
#133045

CHECK
OUR WEEKLY
CIRCULAR FOR
CURRENT
PRICES

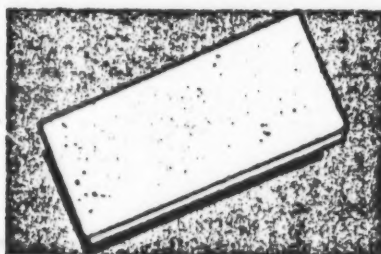


**1/4" x 4' x 8'
PEGBOARD**
Perfect for workshop
and garage.

763
SHEET

#105025

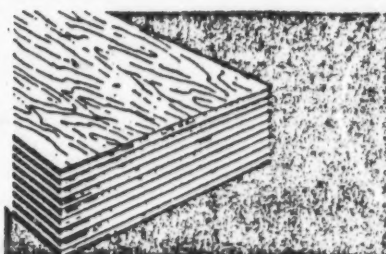
Hardboard 1/4" #105015 **6.98**



**1/2" x 4' x 8'
HOMASOTE**
Moisture and termite resistant.
Durable and weatherproof.

1096
SHEET

#103010

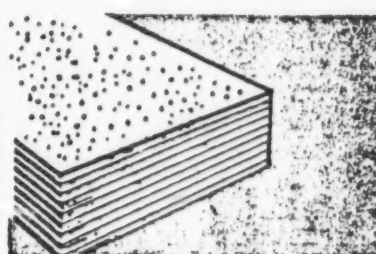


**3/4" x 4' x 8' BIRCH
LUMBER CORE**
Ideal for kitchen cabinet con-
struction.

CHECK OUR WEEKLY
CIRCULAR FOR
CURRENT PRICES

White #144800

Red #144900



**FIRST QUALITY
PARTICLE-BOARD**
Smooth both sides. For carpet
underlayment.

3/8" x 4' x 8' 1/2" x 4' x 8' 5/8" x 4' x 8'

#146200

#146250

#146300

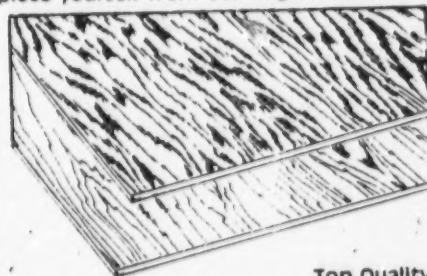
OPEN THURS./FRI. TILL 9:00

PAGE 9

• Winning Project Values on Quality Sheathing and Plywood •

Self-Selection:

We stock a wide assortment of lumber products to guarantee you a quality selection. To ensure you receive the correct lumber, you can choose each piece yourself from our huge inventory.



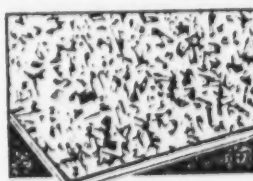
Top Quality
4'x8' SANDED PLYWOODS
Smoothly sanded. Fine appearance features for your finish projects. Self-selection.

Thickness	Use For	Price
1/4"	Hobbles, Crafts	9⁷⁵
3/8"	Fascia, Soffits	11⁰⁹
1/2"	Soffits, Sandboxes	13⁷⁹
3/4"	Tabletops, Bookcases	18⁸⁹
5.2mm Lauan	Carpet underlayment and Paneling	8⁴⁸
3/4" Lauan	All Types of Furniture	29⁹⁷
3/4" Birch	Cabinets, Tables	39⁷⁵

Agency Certified **4'x8' PLYWOOD SHEATHING**

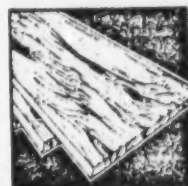
Guaranteed against delamination. Plywoods have a waterproof bond making them an excellent building material for roofs, walls and subfloors. Use indoors or out.

Size	Span Rating	Use For	Price
3/8"	24/0	Roof and walls	7⁶⁹
1/2" 3 Ply	32/16	Roofs, walls and subfloors	7⁹⁸
1/2" 4/5 Ply	32/16	Roofs, walls and subfloors	8⁹⁸
5/8"	42/20	Super strong subfloor	11³⁸
3/4"	48/24	Super strong subfloor	13⁷⁹

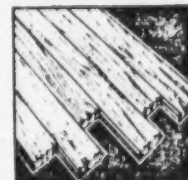


628

4x8x7/16"-Top Quality
WAFERBOARD SHEATHING
Exterior grade. Span rating 24/0. Solid core. Use in or out. Self-select. #353508.
• 1/4"-#305581 **5.88**

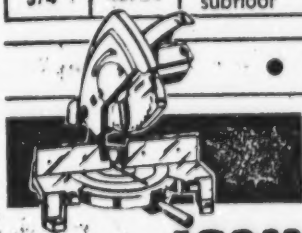


1⁹⁹
1x10x3"-Kiln Dried
PINE SHELVING
Smoothly planed all sides.
• 4' **2.95** • 6' **4.85**

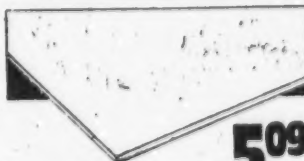


49^c
1x4 Kiln Dried
PORCH FLOORING
Tongue and grooved or smooth 4 sides.

• Project Completers For the Remodeler In You •



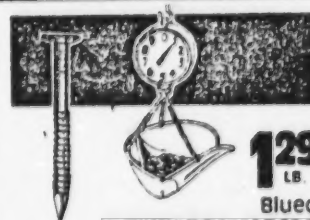
169⁹⁹
Reg. 199.99-Double Insulated
10" MITER SAW
Calibrated miter scale. Fast acting electric brake. #780866.



5⁰⁹
4x8x3/8"-First Quality
GYPSON WALLBOARD
Economical base for paint, paper.
• 4x8x1/2"-#164210 **5.19**



8⁹⁹
5 Gal.-Ready To Use
JOINT COMPOUND
For proper installation of gypsum wallboard. Net 4 1/2 gals. #167999.



1²⁹
Blued
DRYWALL NAILS
Choose the size to complete your drywall project. 1-3/8" or 1-5/8".
ZONE 22 PAGE 11

APPENDIX 9

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